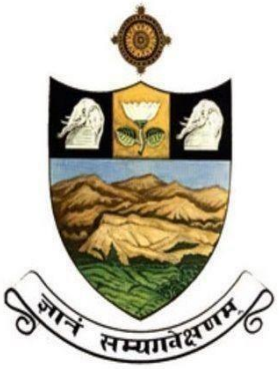
SRI VENKATESWARA UNIVERSITY :: TIRUPATI

Department of Mechanical Engineering

S.V. University College of Engineering:: Tirupati



R – 20 Scheme of Instruction and Syllabi of all Semesters
B. Tech Programme

in

Mechanical Engineering

Effective from the batches admitted from 2020 – 21

PROGRAM OUTCOMES

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineeringproblems reaching substantiated conclusions using first principles of mathematics, natural sciences,andengineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and designsystem components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of theinformationto providevalid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with anunderstandingofthelimitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to theprofessionalengineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions insocietal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

10. **Communication**: Communicate effectively on complex engineering activities with the engineeringcommunity and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineeringand management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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Semester – V (Third year)

Sl. No	Course Code	Name of the Course	Category	Scheme of Instructions Hours per week				Credit
				Lectur	Tutoria	Practica	Drawing	
01	ME501C	Design of Machine Elements	PCC	e 3	l 01	l		03
02	ME502C	Heat Transfer	PCC	3	01			04
03	ME503C	Machine Drawing	PCC	3	01		04	03
04	ME504E	Professional Elective	PEC	3				03
05	ME505O	Open Elective ***(MOOCS)***	OEC	3				03
06	ME506L	Machine Tools Lab	PCC			3		1.5
07	ME507L	Heat Transfer Lab	PCC			3		1.5
08	ME508S	Finite Element Analysis	SAC	1		2		02
09	MC509A	Universal Human Values	MC	2				00
10		Summer Internship (2 Months)						1.5
		Mandatory* **Total**		**18**	**03**	**8**	**04**	**22.5**

SAC – Skill advanced course : 02 Credits -
PCC – Professional Core Course: 13 Credits
PEC – Professional Elective Course – 03
credits OEC – Open Elective Course – 03
credits Summer internship – 1.5 credits
MC – Mandatory Course as prescribed by AICTE, New Delhi and it is **a non – credit** course

Note 1: Evaluation of SDC/SAC is similar to the evaluation process of regular laboratory work.

Note: Summer Internship for two months after second year (to be evaluated during V semester)

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Semester – VI (Third year)

Sl. No	Course Code	Name of the	Category	Scheme of Instructions				Credit
				Lecture	Tutorial	Practical		
01	ME601C	Machine Design	PCC					3
02	ME602C	Dynamics of Machinery	PCC	3				3
03	ME603C	Metrology and Instrumentation	PCC	3				3
04	ME604E	Professional	PEC	3				3
05	ME605O	Open Elective ***(MOOCS)***	OEC	3				3
06	ME606L	Simulation	PCC			3		1.5
07	ME607L	Lab Dynamics	PCC			3		1.5
08	ME608L	Lab Metrology	PCC					1.5
09	ME609S	Lab	SAC			3		2
10	MC 610A	Professional	MC	2				0
	Total			**1**	**0**	**0**		**21.**

SAC – Skill advanced course : 02 Credits
PCC – Professional Core Course: 13.5
Credits
PEC – Professional Elective Course – 03 credits
OEC – Open Elective Course – 03 credits
MC – Mandatory Course as prescribed by AICTE, New Delhi

Note: Research /Industrial Internship *after third year* to be evaluated during *VII semester*

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Semester – VII (Fourth year)

Sl. No	Course Code	Name of the	Category	Scheme of Instructions				Credit
				Lecture	Tutoria	Practical		
01	ME701C	Industrial Engineering and	PCC					3
02	ME702C	Management	PCC	03				3
03	ME703C	Automobile Engineering	PCC	03				3
04	ME704E	Professional Elective	PEC	03				3
05	ME705E	Professional Elective	PEC	03				3
06	ME706O	Open Elective ***(MOOCS)***	OEC	03				3
07	ME707S	Robot Programming	SAC			3		2
08		Industrial Internship (2 Months)*						3
	Total			**1**		**3**		**2**

SAC – Skill advanced course : 02 Credits
PCC – Professional Core Course: 09 Credits
PEC – Professional Elective Course – 06 credits
OEC – Open Elective Course – 03 credits
Research/Industrial internship – 03 credits

***Research /Industrial Internship after third year to be evaluated during VII semester**

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Semester – VIII (Fourth year)

Sl. No	Course Code	Name of the	Category	Scheme of Instructions				Credit
				Lectur	Tutorial	Practica	Drawin	
01		Major	PROJ		l			12
	Total							**1**

Total number of credits for B. Tech (Mechanical Engineering) Programme – Finalized

Year	Semeste		Credit
First	r	**19**	s
	1st	**18**	
Secon	**Semester**	**21.**	**4**
d	**2nd**	**5**	
	Semester	**22.**	**4**
	1st	**5**	
Fourt	**Semester**	**22.**	**35**
h	**2nd**	**5**	
	Eight		**16**

Division (breaking – up) of Core Subjects/Courses According to Stream (excluding electives and basic science courses):

Thermal	Manufacturing	Management	Design
04 (BTD,ATD,HT and AE)	03 (MP, MT& MC, Metrology)	02 (IE and M, OR)	04 (KoM, DoM, Machine Design, DoME)

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Semester – wise Grouping of Professional Electives Courses (PECs)

Semester	Professional Elective Courses
V	1) Advanced Manufacturing Processes 2) Non – conventional Energy Sources
VI	3) Tool Design 1) Engineering Materials and Metallurgy 2) Robotic Engineering
VII	3) NC and CNC Systems 1) Additive Manufacturing 2) Quality control and Reliability
	3) Refrigeration and Air – conditioning 1) Finite Element Method 2) Nanotechnology

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Semester – wise Grouping of Open Electives Courses (OECs)**

Semester	Open Elective Courses
	First OEC through SWAYAM platform (MOOCS)
VI	Second OEC through SWAYAM platform (MOOCS)
VII	Third OEC through SWAYAM platform(MOOCS)

**Open elective courses (OECs) are to be completed/done through MOOCS on SWAYAM platform (mostly NPTEL courses offered by premier institutes such as IITs and NITs).

Hence, the list of courses will vary depending upon the availability of slots pertaining to the courses offered by those premier institutes during a particular academic year.

1. PEC (Professional Elective Courses) and OEC (Open Elective Courses)

In REC – 20 (Revised Engineering Curriculum) draft provided by APSCHE the following points are highlighted with regard to MOOCs: **(page 10, point 09)**

There shall be **05** Professional Elective courses (PEC) and **04** Open Elective courses (OEC). All the Professional & Open Elective courses shall be offered for **03 credits**, wherever lab component is involved it shall be (2-0-2) and without lab component it shall be (3-0-0). If a course comes with a lab component, that component has to be cleared separately. The concerned BoS shall explore the possibility of introducing virtual labs for such courses with lab component.

All Open Electives are offered to students of all branches in general. However, a student shall choose an open Elective from the list in such a manner that he/she has not studied the same course in any form during the Programme.

But, we propose to offer 04 PEC and 03 OEC.

2. Courses under MOOCS

In REC – 20 (Revised Engineering Curriculum) draft provided by APSCHE the following points are highlighted with regard to MOOCs: **(page 10, point 11)**

A student shall be permitted to pursue up to a maximum of **two elective courses under MOOCs** during the Programme. Each of the courses must be of minimum 12 weeks in duration. Attendance will not be monitored for MOOC courses. Student has to pursue and acquire a certificate for a MOOC course only from the organizations/agencies approved by the BoS in order to earn the 3 credits. The Head of the department shall notify the list of such courses at the beginning of the semester.

3. Summer Internship and its Evaluation

Evaluation of the summer internships shall be through the **departmental committee**. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the departmental committee. The **report and the oral presentation** shall carry **40% and 60%** weightages respectively.

In the final semester, the student should mandatorily undergo internship and parallelly he/she should work on a **project with well-defined objectives**. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an ***external examiner*** .

4. COMMUNITY SERVICE PROJECT

Community Service Project should be an integral part of the curriculum, as an ***alternative to the 2months of Summer Internships*** / Apprenticeships / On the Job Training, whenever there is an exigency when students **cannot pursue their summer internships**.

The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of the society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of boxsolutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.

  - Every student should put in a minimum of **180 hours** for the Community ServiceProject during the summer vacation.
  - Each class/section should be assigned with a mentor.

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ME501C DESIGN OF MACHINE ELEMENTS

Effective from- 2020-21

Lectures / Week: 3 Periods + 1 Tutorial **credits:3**

Objectives

This course seeks to provide an introduction to the design of machine elements commonly encountered in mechanical engineering practice through

1. A strong background in mechanics of materials based failure criteria underpinning the safety – critical design of machine components
2. An understanding of the origins, nature and applicability of empirical design principles, based on safety considerations
3. An overview of codes, standards and design guidelines for different elements
4. An appreciation of parameter optimization and design iteration
5. An appreciation of the relationships between component level design and overall machine system design and performance

Course Contents

UNIT-I

Engineering Design
What is designing? ; The process of Design; design by evolution; Identification and analysis of need; True need; Specifications ; Standards of performance ; use of checklists ; Morphological Analysis ; Brainstorming; measure of physical realizibility; Designing for shipping, handling and installation; Design considerations; Design tools and resources; Design Engineer‟s Professional Responsibilities; Standards and Codes;

UNIT-II

Design Considerations – limits, fits and standardization, Modes of failure, factor of safety; Stress – strain relationships; Stress-strain relationships; shear stress and shear strain relationships; Review of failure theories for static and dynamic loading(including fatigue failure), Stress concentration factors; Reduction of stress concentration effects; Fluctuating stresses; fatigue failure; Endurance limit; Notch sensitivity; Soderberg and Goodman Diagrams; Modified Goodman‟s diagrams; fatigue design under combined stresses. Design for finite and infinite life.

UNIT-III

Design of Shafts and Keys; Design of shafts under static and fatigue loadings; Axial, Bending, Torsional stresses; Principal stresses; theories of failure. Couplings.
Keys; types of keys; Design os hank key; Effect of keyway. Design of splines.

UNIT-IV

Design of shaft couplings and pipe joints; Introduction; Types of shaft couplings; Design of sleeve or muff couplings, Clamp or Compression coupling, Flange couplings. Design of bushed type flexible coupling. Pipe Joints: Introduction, Design of pipe joints, hydraulic pipe joints, Design of flanged pipe joints

UNIT-V

Design of fasteners Threaded joints – Thread joints; ISO metric screw threads. Bolted joint in tension; Torque requirements for bolt tightening; bolted joint under fluctuating load; eccentricity loaded bolted joints in shear; bolted joints with combined stresses; Bolt of uniform strength. Analysis and applications of power screws.
Welded joints – types of welded joints; stresses in butt and filler welds; strength of welded joints; Eccentric loaded welded joints; weld joint subject to bending moment and fluctuating forces; welding symbols; welded inspection.

TEXT BOOKS:

1. Shigley J. E and Mischke, C.R.: Mechanical Engineering Design, Fifth Edition, McGraw Hill International, 1989
2. Deutschman D. Michels, W.J. and Wilson, C.E, Machine Design Theory and Practice, MacMillan, 1992,
3. Juvinal, R.C., Fundamentals of Machine component esign, John Wiley, 1994
4. Spottes, M.F., Design of Machine Elements, Prentice – Hall India, 1994
5. R.L. Norton, Mechanical Design – An integrated Appoach, Prentice Hall, 1998

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2	3									
CO2		**2**	3									
CO3	1	2	**3**									
CO4		2	**3**									
CO5	1	2	3									

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ME502C HEAT TRANSFER

Lectures/Week: 4
periods Tutorial/Week
: 1 Hrs.

Credits: 4
Sessional marks: 20
+20 End Examination
Marks: 60

UNIT – I

General Modes of Heat Transfer: Basic modes of Heat Transfer, Basic laws of Heat Transfer, Applications of Heat Transfer, Fourier law of heat conduction, Newton‟s law of Cooling Basic equations, Coefficient of thermal conductivity convective, Heat transfer coefficient, Stephan Boltzmann constant, Overall heat transfer coefficient.

Conduction in steady state

Theory of heat conduction, Heat flow through plane wall and cylinder with Variable Thermal conductivity, Conduction through slabs, cylinders and spheres, Concept of thermal resistance, critical thickness insulation, logarithmic mean area, concept of shape factor, one dimensional steady state conduction with heat addition.

UNIT – II

Conduction : Conduction in unsteady state periodic and a periodic temperature variance, infinite semi and infinite solids general equations for conduction in unsteady state, lumped capacitance method, transfer heat flow in semi- infinite solid, convection boundary conditions – use of Grober / Heisler charts.

UNIT – III

Radiation: Introduction, Applications of Radiation, Nature of radiation, Emissive Power-Absorption, Reflection and Transmission, concept of black body, gray body, Planck‟s Law, Stephan Boltzmann law, Kirchhoff „s law, Radiation shape factor relations, Heat exchange between black bodies, Heat exchange between non-black bodies, introduction to radiation network analysis, Radiation shields.

UNIT – IV

Convection:

Heat transfer due to free convection: Introduction, Applications, Free convection heat transfer on a vertical flat plate, Empirical correlations for vertical plates and cylinders, horizontal plates and cylinders, Natural convection cooling in electronic equipment, heat pipe.

Heat transfer due to forced convection: Introduction, Applications, Principles of convection, The boundary layer concept-The velocity and Thermal boundary layer, Laminar boundary layer on a flat plate thermal boundary layer, empirical relations, laminar and turbulent flows, heat transfer in laminar flow over a flat plate, heat transfer in turbulent flows, relations between fluid friction and heat transfer, heat transfer in laminar tube flow, turbulent flow in pipes, flow across cylinders and spheres.

UNIT – V

Heat Exchangers: Introduction, Classification of heat exchangers**,** overall heat transfer coefficient, Fouling factors, LMTD method of Heat exchanger analysis, effectiveness of heat exchangers, NTU method, Compact heat exchangers, different considerations.

Heat transfer through extended surfaces: Theory of fins, fins of uniform cross-sectional area, Analysis of Long Fin and Short fin with insulated tip, heat transfer calculations, fin efficiency, fin effectiveness.

TEXT BOOKS:

1. Heat Transfer : Holman J P
2. Heat Transfer : Mahesh M. Rathore
3. Fundamentals of Engineering Heat and Mass Transfer : Sachdeva R C
4. Fundamentals of Heat and Mass Transfer : Kothandaraman
5. Heat Transfer : R.K. Rajput
6. Basic Heat and Mass Transfer : Mills. A
7. Heat Transfer : Y.A. Cengel

REFERENCES:

1. Introduction to Heat Transfer : Frank P Tancropera David P Dewitt
2. Heat Transfer : Ozisik
3. Principles of Heat Transfer : Frank Kreith
4. Heat and Mass Transfer : Yadav R.
5. Heat Transfer : Ballaney P L

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2	3									
CO2		**2**	3									
CO3	1	2	**3**									
CO4		2	**3**									
CO5	1	2	3									

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ME503C Machine Drawing

Effective from- 2020-21

Lectures / Week: 3 Periods + 1 Tutorial **credits:3**

Unit – I

Orthographic Views: Conversion of Pictorial views into Orthographic views with sectioning.

Unit - II

Machine Elements: Drawing views of the following machine elements: Thread profiles, Bolted joint, machine and cap screws, types of nuts, locking devices for nuts, Foundation Bolts.
Keys: Sunk Keys, Feather Keys, Spline Shaft, Wood – Ruff Key and round Key.

Unit – III

Shaft Couplings: Muff Coupling, Split muff Coupling, Flanged Coupling, protective type flanged coupling.
Riveted Joints: Different types of rivet heads, Different types of lap joints and butt joint.

Unit – IV

Assembly Drawing: Preparation of assembly drawing of Plumber Block, Foot Step Bearing, Swivel Bearing, Screw jack, Stuffing Box, Pipe Vice, Lathe tail Stock, Clapper box, Drill Jig, Cross head, Air cock.

Unit – V

Part Drawing: Preparation of part drawing of IC engine connecting rod, Revolving Centre, Square tool post, Eccentric, V- Belt drive, Drill jig, Cross head.

TEXT BOOKS:

1. Narayana K.L, Kannaiah P. and Venkata Reddy K.: Machine Drawing, Third Edition, New Age International, 2006.
2. K.C. John: Text Book of Machine Drawing, PHI Learning Private Ltd, 2010.
3. Narayana K.L, Kannaiah P. and Venkata Reddy K.: Production Drawing, Second Edition, New Age International, 2010 reprint.

REFERENCES:

1. Bhatt N.D.: Machine Drawing, Charotor Publishers, 2008
2. Dhawan R.K.: Machine Drawing, Second Edition, S. Chand & Company Limited, 1998

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2	3									
CO2		**2**	3									
CO3		2	**3**									
CO4		2	**3**									
CO5		2	3									

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ME504E ADVANCED MANUFACTURING PROCESSES

Lectures/Week: 3 periods

Credits: 3

Sessional marks: 20 +20
End Examination Marks: 60

UNIT-I

MATERIAL REMOVAL PROCESSES: Introduction, history of machining, traditional machining processes, non-traditional machining processes, hybrid machining processes. need for non-traditional machining processes.

MECHANICAL PROCESSES: Ultrasonic machining - Introduction, the machining system, material removal process, factors affecting material removal rate, dimensional accuracy and surface quality, applications.
Water jet machining - Introduction, The machining system, Process parameters, Applications, Advantages and disadvantages of Abrasive jet machining - Introduction, Machining system, Material removal rate, Applications, Advantages and limitations of AJM.

UNIT-II

CHEMICAL PROCESSES: Chemical Milling - Introduction, Tooling for CHM, Process parameters, Material removal rate, Accuracy and surface finish, Advantages, Limitations, Applications
Photochemical Milling - Introduction, Process description Applications, Advantages
Electro Polishing - Introduction, Process parameters, Applications, Process limitations.
ELECTROCHEMICAL PROCESSES: Electro Chemical Machining: Introduction, Principles of electrolysis, Theory of ECM, ECM equipment, Basic working principles, Process characteristics, Process control, Applications
Basics of Electrochemical Drilling, Electro-Chemical Deburring, and Electro stream drilling

UNIT-III

HYBRID ELECTROCHEMICAL PROCESSES: Electro Chemical Grinding - Introduction, Material removal rate, Accuracy and surface quality, Applications, Advantages and disadvantages
Electrochemical Honing - Introduction, Process characteristics, Applications
Electrochemical Super Finishing - Introduction, Material removal process, Process accuracy
Electrochemical Buffing - Introduction, Material removal process

UNIT-IV

THERMAL PROCESSES: Introduction, Mechanism of material removal, The machining system, Material removal rates, Heat-affected zone, Applications. Wire EDM principle, Process parameters, surface finish and machining accuracy, applications. Laser beam machining - Introduction, material removal mechanism, applications, advantages and limitations.
electron beam machining - introduction, basic equipment and removal mechanism, applications,

advantages and disadvantages. Plasma beam machining - introduction, machining systems, material removal rate, accuracy and surface quality, applications, advantages and disadvantages. Ion beam machining - introduction, material removal rate, accuracy and surface effects, applications

UNIT-V MATERIAL ADDITION PROCESSES: INTRODUCTION, CLASSIFICATION :
Liquid-Based Techniques – stereo-lithography, holographic interference solidification, beam interference solidification, solid ground curing-liquid thermal polymerization, fused deposition, modeling, multi jet modeling, ballistic particles manufacturing, shape deposition manufacturing. Powder based processes - selective laser sintering,
laser engineered net shaping, three-dimensional printing. Solid-Based techniques -solid foil polymerization, laminated object modeling.

TEXT BOOKS:

El-Hofy, Hassan Abdel-Gawad, "Advanced Machining Processes: Nontraditional And Hybrid Machining Processes", McGraw-Hill, 2005.

REFERENCES:

1. Pandey P.C. and Shah H.S, "Modern Machining Processes", 1st Edition, TMH, 2010.
2. Bhattacharya A, "New Technology, the Institution of Engineers", India 1984.
3. V. K. Jain, "Advanced machining processes", 1st Edition, Allied publishers, 2010

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			3						2			
CO2			3						2			
CO3			**3**		2							1
CO4			**3**		2							
CO5			3		**2**							

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ME504E NON – CONVENTIONAL ENERGY SOURCES

Lectures/Week: 3 periods

Credits: 3

Sessional marks: 20 +20

End Examination Marks: 60

UNIT – I

Introduction:

The solar energy option – Energy Scenario – Survey of Energy Resources – Classification – Need for Role and potential of new and renewable sources.

Principles of Solar Radiation:

Physics of the sun – The solar constant – Solar radiation on tilted surface – Instruments for measuring solar radiation and sunshine – Solar radiation data.

UNIT – II

Solar Energy Collection:

Flat plate and concentrating collectors – Classification of concentrating collectors – Orientation and Thermal analysis – Advanced collectors.

Solar Energy Storage:

Different methods – Sensible, Latent heat and Stratified storage – Solar Ponds

Solar Applications:

Solar heating/cooling techniques – Solar distillation and drying - Photovoltaic energy conversion.

UNIT – III

Wind Energy:

Sources and potentials – Horizontal and Vertical axis windmills – Performance characteristics.

Biogas and Bio-Mass:

Principles of Bio-conversion – Anaerobic/Aerobic digestion – Types of Bio-gas digesters – Gas yield – Combustion characteristics of bio-gas – Utilization for cooking, I.C. engine operation – Economic aspects.

UNIT – IV

Geothermal Energy:

Resources – Types of wells – Methods of harnessing the energy – Potential in India.

OTEC:

Principles – Utilization – Setting of OTEC plants - Thermodynamic cycles.

Tidal and Wave Energy:

Potential and Conversion techniques – Mini-hydel power plants – Their economics.

UNIT – V

Direct Energy Conversion:

Need for DEC – Carnot cycle – Limitations – Principles of DEC – Thermo-electric generators – Seebeck, Peltier and Joule Thompson effects – Figure of merit – Materials – Applications – MHD generators – Principles –

Dissociation and Ionization – Hall effect – Magnetic flux – MHD accelerator – MHD engine – Power generation systems – Electron gas dynamic conversion – Economic aspects

Fuel Cells:

Principle – Faraday‟s laws – Thermodynamic aspects – Selection of fuels and Operating conditions.

TEXT BOOKS:

1. Rai G.D. : Non-conventional Energy Sources, Standard Publishers Distributors.
2. Ashok V Desai : Non-conventional Energy, New Age International.
3. K. Udayakumar, M. Anandakrishnan: Renewable Energy Technologies, Narosa, 1997.

REFERENCES:

1. Twidell and Weir: Renewable Energy Sources, 2nd Edition, Taylor & Francis, 2006.
2. Sukhatme: Solar Energy, 1st Edition, Tata McGraw-Hill Education, 2008
3. D. Yogi Goswami, Jan F. Kreider.:Solar Power Engineering, 2nd Edition, Taylor & Francis, 2006.

Mapping of Course Outcomes with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2									
CO2	2		2	2								
CO3		1		2	2							
CO4			2	2	3							
CO5		1	1	2								

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ME504E TOOL DESIGN

Lectures/Week: 3 periods

Credits: 3

Sessional marks: 20 +20
End Examination Marks: 60

COURSE OBJECTIVES:

- To develop a solution oriented approach by in depth knowledge of Tool Design.
- To address the underlying concepts, methods and application of Tool Design.

CONTENTS:

UNIT –I

Cutting Tools Classification – Nomenclature of single point cutting tool – Differences between orthogonal and oblique cutting – Mechanism of metal cutting – Types of chips – chip breakers – Forces acting on a tool – Merchant circle diagram – Velocity relations – specific energy in cutting.

UNIT-II

Tool Wear – Tool life – Factors affecting tool life – Taylor's Tool life Equation – Tool wear mechanisms – Types of tool wear – Heat distribution in metal cutting – Measurement of temperature in metal cutting – Lathe tool Dynamometer – Cutting fluids – Selection and applications.

UNIT-III

Cutting Tool Materials- Requirements of tool materials, advances in tool materials, HSS, Coated HSS, Carbides ,Coated Carbides, Ceramics, Cold pressed, Hot Pressed , Ceramic composites, CBN, Diamond- properties, Advantages and limitations; Specifications for Inserts and tool holders. Design of single point cutting tool and form tool for NC Lathe work- Design of profile milling cutter and broach tools

UNIT- IV

Press Working and Economics of Machining: Press working operations- Press selection and Tonnage- Centre of Pressure- Cutting forces and clearances for Die Design – Compound and Progressive Die, Strip layout. Costs associated with machining operations- Optimum cutting speed for minimum cost and maximum production, cutting speed for minimum cost in Turning.

UNIT-V

Jigs & Fixtures- Uses- Locating devices, 3-2-1 principle of location – pin location- Radial location- 'V' location- Diamond locators. Types of clamping devices- principles of clamping. Design principles to Jigs & Fixtures – Drill Jigs, types- Drill Bushes, types- Fixtures for Turning, Milling and Welding.

TEXT BOOKS:

1. Fundamental of Tool Design – ASTME, Prentice Hall, New Delhi, 1987
2. Donaldson, Lecain and Goold - "Tool Design", McGraw Hill, New York, 1976

REFERENCES:

1. BLJuneja and GSSekhan, "Fundamental of Metal Cutting and Machine Tools", 2nd Edition, New Age International Publishers, New Delhi,2003
2. Milton C.Shaw, "Metal Cutting Principles", 1stEdition,CBS Publishers & Distributors Pvt.Ltd,2002.
3. Kempster, "In Introduction to Jig and Tool Design", ELBS, 1974.
4. Herman W. Pollack ,"Tool Design", Prentice Hall, New Delhi.
5. Clade S. George Jr : Management For Business Industry,1972

COURSE OUTCOMES:

DISCRIPTION OF THE COURSE OUTCOME Upon completion of this course, students will be able to	
CO1	Design single point and multipoint cutting tools.
CO2	Find out the tool wear using different techniques and also select cutting fluids to reduce the heat.
CO3	Select cutting tool materials for different operations.
CO4	Select and design dies for press working operations.
CO5	Design jigs and fixtures and Understand principles of locating and clamping systems.

Mapping of Course Outcomes with Program Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	3	2	1	1	-	-	-	-	-	1
CO2	3	2	3	2	1	1	-	-	-	-	-	1
CO3	3	2	3	2	1	1	-	-	-	-	-	1
CO4	3	2	3	2	1	1	-	-	-	-	-	1
CO5	3	2	3	2	1	1	-	-	-	-	-	1

Department of Mechanical Engineering
S. V. University College of Engineering:: TIRUPATI

ME506L MACHINE TOOLS LABORATORY

Credits: 1.5

Laboratory/week: 3 hours

Internal Test: 40 Marks

End Examination: 60 Marks

(Any eight of the following experiments will be given)

List of Experiments:

1. Force Measurement on Lathe
2. Power Measurement on Lathe
3. Production of Single point cutting tool using tool and cutter grinder
4. Differential Indexing
5. Alignment Test on Lathe
6. Alignment Test on Radial Drilling Machine
7. Thrust and Toque Measurement in Drilling Operation
8. Measurement of Tool Wear
9. Study of weld Bead in Arc Welding
10. Measurement of Forces in Milling
11. Study of Impact strength tests on Welded joints

Mapping of Course Outcomes with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1				2	2					1
CO2		1		2		1	1					
CO3		2			1		2					2
CO4				1	1		2					
CO5	1			1	2		1					

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ME507L HEAT TRANSFER LABORATORY

Credits: 1.5

Laboratory/week: 3 hours

Internal Test: 40 Marks

End Examination: 60 Marks

(*Any nine of the following experiments will be given*)

List of Experiments:

1. Test on Thermal conductivity of metal rod.
2. Test on Thermal conductivity of slab.
3. Test on Emissivity Measurement Apparatus.
4. Test on Lagged Pipe Apparatus.
5. Test on Steffan-Boltzman Apparatus.
6. Test on Finned tube heat exchanger.
7. Test on Natural Convection Apparatus.
8. Test on Forced Convection Apparatus.
9. Test on Vapour compression test rig.
10. Test on parallel flow and counter flow heat exchanger
11. Test on thermal conductivity of liquids.

Mapping of Course Outcomes with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1			1						
CO2	1	1	2									1
CO3		2				2	2	1				
CO4				1	2		2					1
CO5			1		2	3	3					1

Department of Mechanical Engineering
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ME601C MACHINE DESIGN

Lectures/Week: 3 periods Tut/week: 1 period

Credits: 3

Sessional marks: 20 +20

End Examination Marks: 60

UNIT – I

Statistical Considerations in Design

Frequency distribution , characteristics of frequency curves, measures of central tendency and dispersion, probability – probability distribution – normal curve – population combinations – design and natural tolerances

UNIT – II

Mechanical Springs

Helical springs – stress equation and deflection equation; spring materials; spring end formation; design against – static and fluctuating loads; Design of helical and Torsional springs; Compound springs; equalized stress in spring leaves; multi leaf springs; nipping and shot peening

UNIT – III

Sliding contact bearings

Classification of bearings Hydrodynamic lubricated bearings; Materials for sliding contact bearings; Lubricants – Properties and their selection Terminology used in hydrodynamic journal bearings. Design procedure for journal bearings – Heat in bearings. Design of collar bearings.

Rolling Contact bearings :

Merits and demerits of rolling contact bearings over sliding contact bearings. Types of rolling contact bearings. Static and dynamic load capacities. Equivalent bearing load . Design for cyclic loads. Selection of radial ball bearings.

UNIT – IV

Gears: Types of gears and their applications, gear materials allowable stresses, Law of gearing Spur gears: Terminology, force analysis, Design of spur gears – Lewis equation. Check for dynamic load and

wear load. Gear wheel proportion.
Helical gears; terminology, design of helical gears, Check for wear load. Force analysis.

UNIT-V

Engine parts:
Pistons, forces acting on pistons – Construction, Design and proportions of Pistons.
Connecting rod: Thrust in connecting rod – stress due to whipping action on connecting rod ends – Cranks and crank shafts. Strength and proportions of overhang and center cranks – Crank pins, Crank shafts.

TEXTBOOKS:

1. Lal G.K., Vijay Gupta, Venkata Reddy N: Fundamentals of Design and Manufacturing , Alpha Science International, 2005
2. Bhandari V.B.: Design of Machine Elements, Third Edition, TataMcGrawHill, 2010.
3. Shigley J.E: Mechanical Engineering Design, Third Edition, Tata McGrawHill, 2010.

REFERENCES:

1. AllenStrickl and Hall, Alfred R. Holowenko, Herman G. Laughlin: Machine Design, Schaum Series, Tata McGrawHill, 2010.
2. Faires V.M.: Design of Machine Elements, Fourth Edition, Macmillan, 1965
3. Sharma P.C. and Aggarwal D.K.: Machine Design, S.K.Kataria and Sons, 1997
4. Jain R.K.: Machine Design , Fifth Ediiton, Kanna, 1988.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2	3									
CO2		2	3									
CO3		2	3	1								
CO4		2	3									
CO5		2	3									

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ME602C DYNAMICS OF MACHINERY

Lectures/Week: 3 periods Tut/week:

Credits: 3

Sessional marks: 20 +20

End Examination Marks: 60

COURSE OBJECTIVES:

- To impart the knowledge on gyroscopic couple, friction applications to analyze the systems.
- To understand the concepts of flywheels and governors.
- To study the balancing of masses, vibration concepts for applying in different applications.

CONTENTS:

UNIT –I

Gyroscopic Couple and Force Analysis –effect ofprecession–motion on the stability of movingvehicles such as motorcycle – motorcar – aero planes and ships. Static and Dynamic Force Analysis of planar mechanisms.

UNIT–II

Friction:

Friction of screw and nuts - Pivots and collars – uniform pressure,uniform wear – friction circle and friction axis: lubricated surfaces – boundary friction – filmlubrication..

Applications: Simple block brake - Internal expanding brake- band brake of vehicle. Dynamometers – absorption and transmission types. General description and methods of operation. Clutches- Singleplate, multiplate, cone clutches.

UNIT–III

Turning Moment Diagram and Flywheels: Turning moment- Inertia torque-connecting rodangularvelocity andacceleration-crank effort andtorque diagrams-fluctuation of energy – flywheelsandtheir

Governors: Watt, Porter and Proell governors-Spring loaded governors–Hartnell and Hartung - Sensitiveness, iso-chronisms and hunting– effort and power ofthegovernors.

UNIT–IV

Balancing of masses: Static and dynamic balance, balancing of rotating masses - analytical and graphical methods. Balancing of reciprocating masses – Partial balancing – locomotive balancing – variation of tractive effort. Swaying couple and Hammer blow. Single and multi cylinder in line engines – firing order. Balancing of radial and V engines. Practical Methods of balancing of rotors.

UNIT –V

Vibrations: Free and forced vibration of single degree of freedom system, Role of damping, whirling of shafts and critical speeds. Free, forced and damped vibrations. Vibration Isolation and

Transmissibility, Transverse vibrations of beams with concentrated and distributed loads, Dunkerly's method, and Raleigh's method. Torsional vibrations - two and three rotor systems.

TEXTBOOKS:

1. Theory of Machines : R.K.Bansal
2. Theory of Machines : S.S. Rattan
3. Mechanisms and Machine Theory : J.S. Rao and R.V. Dukkipati
4. Theory of Vibrations : Thomson

REFERENCEBOOKS:

1. Theory of Machines and Mechanisms : Joseph Edward Shigely
2. Theory of Machines : Thomas Bevan
3. Mechanical Vibrations : Dehhartog.

COURSE OUTCOMES: Upon completion of this course, students will be able to

	DISCRIPTION OF THE COURSE OUTCOME
CO1	Learn the concepts of gyroscopic effects on the stability of ships, aeroplanes and Automobiles. Learn the concepts of static and dynamic force analysis of planar mechanisms.
CO2	Understand the concepts of friction-clutches, brakes and dynamometers and its importance.
CO3	Understand the importance of turning moment diagrams, fly wheels, governors and its analysis.
CO4	Understand the balancing of rotary and reciprocating masses.
CO5	Understand the different types of vibrations.

Mapping of Course Outcomes with Program Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	1	3	2	2	-	-	-	-	-	-	1
CO2	3	2	3	2	2	-	-	-	-	-	-	1
CO3	3	2	3	2	2	-	-	-	-	-	-	-
CO4	3	2	3	2	2	2	-	-	-	-	-	2
CO5	3	3	3	2	2	-	-	-	-	-	-	2

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ME603C Metrology and Instrumentation

Effective from- 2020-21

Lectures / Week: 3 periods **credits:3**

UNIT –I

Concept of measurement: - Introduction to Metrology; Need for high precision measurements; Terminologies in Measurement-Precision, accuracy, sensitivity, calibration. Errors in Measurement, types of errors, Abbe's Principle Basic standards of length- Line standard, End standards,Wavelength standard; Various Shop floor standards. Linear Measurement – Slip gauges, wringing, grades; Surface plate; Dial indicators; Height gauges and Vernier calipers. Comparators-mechanical, electrical, optical and pneumatic. Angular Measurement – Bevel protractor; Sine Bar, principle and use of sine bar, sine centre; Angle gauges. Sprit level; Angle Dekkor; Clinometers.

UNIT –II

Limits and Limit gauges – Making to suit, selective assembly, systems of limits and fits; Types of fits; Hole basis system and Shaft basis system. Standard systems of limits and fits; Shaft and Hole system; Tolerance, allowance and deviation (as per BIS). Simple problems on tolerance and allowance, shaft and hole system. Limit Gauges – GO and NO GO gauges; types of limit gauges. Gauge design - Taylor's principle of gauging; Gauge tolerance, disposition of gauge tolerance, wear allowance. Optical Measuring Instruments: - Benefits of using light waves as standards; Monochromatic light; Principle of Interference. Interference band using optical flat, application in surface measurement. Interferometers – NPL flatness interferometer, Pitter-NPL gauge interferometer.

UNIT –III

Screw thread measurement – Screw thread terminology; Measurement of major diameter; Measurement of minor or root diameter. Measurement of pitch; Measurement of effective diameter with two wire method and three wire method. Measurement of flank angle and form by profile projector and microscope. Measurement of surface texture – Meaning of surface texture, roughness and waviness; Analysis of surface traces, peak to valley height, R.M.S. value, Centre Line Average and R_a value, Rt, Rz etc. Methods of measuring surface roughness – Stylus probe, Tomlinson surface meter, Talysurf; Terms used in surface
roughness measurement – assessment length, roughness width cutoff, sampling length and evaluation length.
Interference method for measuring surface roughness – using optical flat and interferometers.
Autocollimator, principle and use of autocollimator.

UNIT –IV

Machine tool metrology – Alignment testing of machine tools like lathe, milling machine, drilling machine.
Advanced measuring devices – Laser interferometers. Coordinate Measuring Machine (CMM) – Introduction to CMM; Components and construction of CMM. Types of CMM; Advantages and application of CMM, CMM probes, types of probes – contact probes and non contact probes Machine Vision – Introduction to machine vision, functions, applications and advantages of machine vision. Steps in machine vision.

UNIT –V

Introduction to Mechanical Measurement – significance of mechanical measurement; Fundamental methods of measurement; Classification of measuring instrument. Stages in generalized measuring system – Sensor-Transducer stage, Signal-Conditioning stage, Readout-Recording stage; Types of input quantities; Active and Passive transducers. Performance characteristic of measuring devices – Static characteristics – Accuracy, Precision, Repeatability, Sensitivity, Reproducibility, Drift, Resolution, Threshold, Hysteresis, Static calibration. Dynamic characteristics- different order systems and their response-, Measuring lag, Fidelity, Dynamic error; Types of errors in measurement. Transducers – Working, Classification of transducers. Motion and Dimension measurement – LVDT – Principle, applications, advantages and limitations.

TEXT BOOKS:

1. Anand K Bewoor, Vinay A Kulkarni, Metrology & Measurement, McGraw-Hill, 2009
2. Ernest O. Doebelin, Dhanesh N. Manik, Measurement Systems Application and Design, McGraw-Hill, 2004
3. Galyer J.F.W., Schotbolt C.R., Metrology for Engineers, ELBS,1990
4. Thomas G. Beckwith, John H. L., Roy D. M., Mechanical Measurements, 6/E , Pearson Prentice Hall, 2007

REFERENCES:

1. ASME, Hand book of Industrial Metrology,1998
2. Hume K. J., Engineering Metrology, Macdonald &Co. Ltd.,1990
3. J.P.Holman, Experimental Methods for Engineers,Mcgraw-Hill, 2007
4. Sharp K.W.B., Practical Engineering Metrology, Sir Isaac Pitman & Sons Ltd.,1958

Mapping of Course Outcomes with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1			1	1					
CO2	2	1				1	1					
CO3		2		2		2						1
CO4			1	2			1					
CO5		1		2		3						

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ME604E ENGINEERING MATERIALS AND METALLURGY

Lectures/Week: 3 periods

Credits: 3

Sessional marks: 20 +20
End Examination Marks: 60

UNIT -1

Space lattice and unit cells, Crystal structures of common metallic materials – bcc –fcc- hcp – Atomic packing factor – Miller indices –spacing of lattice planes –Relation between density and lattice constant. Crystal imperfections –point, line and surface defects. Edge and screw dislocations – Burger's vector. Plastic deformation by slip and twinning .Critical resolved shear stress for slip.

UNIT – II

Testing of Engineering materials –tensile, compressive, hardness and impact tests. Creep –creep test-creep curve- Mechanism of creep. Fatigue – fatigue stress cycles – fatigue test – S-N- curve –Mechanism of fatigue. Fracture – Ductile and brittle fracture –Griffith's criterion.

UNIT – III

Construction of cooling curves for a pure metal and a solid solution / alloy – Gibb's phase rule for a metal system
– Construction and interpretation of binary phase diagrams-Types of phase diagrams –Eutectic ,Eutectoid, Peritectic, Peritectoid.-Iron-Carbon system – cooling curve of pure iron. Iron – carbide equilibrium diagram – Effect of alloying elements on Iron-Iron carbide diagram.

UNIT – IV

Plain carbon steels – Uses and limitations of plain carbon steels. Alloy steels. Effect of alloying elements in steels. High speed tool steel, stainless steels, High nickel and High chromium steels. Cast irons-grey, white, malleable and SG irons. Non- Ferrous metals and alloys –Copper, Aluminum, Magnesium, Nickel and Zinc-Properties and applications.

UNIT –V

Transformation points – Construction of TTT diagram – TTT diagram and cooling curves. Heat treatment of steels
– Annealing, Normalizing, Hardening, Tempering, Austempering, Martempering. Surface hardening of steels – Carburizing, Nitriding, Cyaniding, Flame Hardening and induction hardening.
Powder Metallurgy –production of metal powders- Basic steps in powder metallurgy - advantages limitations and applications of powder metallurgy.

TEXT BOOKS:

1. Avner: Introduction to Physical Metallurgy, Second Edition, Tata McGraw-Hill, 2009.
2. William D. Callister, Jr.: Materials Science and Engineering, John Wiley & Sons Limited, 2008.
3. Daniel Yesudian C.D. & Harris Samuel D.G: Materials Science and Metallurgy.
4. Kodgire V.D.: Materials Science and Metallurgy, Second Edition, Tata McGraw-Hill, 2010.

REFERENCE BOOKS:

1. Raghavan V: Physical Metallurgy, Second Edition, PHI Learning Pvt. Ltd., 2006.
2. William F. Hosford: Physical Metallurgy, Second Edition, Taylor and Francis, 2009.
3. Reza Abbaschian, Lara Abbaschian, Robert E. Reed-Hill: Physical Metallurgy, Fourth Edition, Cengage Learning, 2010.

4 Krishan K Chawla Composite materials 2nd Edition, Springer, 2006

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ME604E ROBOTIC ENGINEERING

Lectures/Week: 3 periods

Credits: 3

Sessional marks: 20 +20
End Examination Marks: 60

UNIT – I

Introduction: Overview - Classification of Robots – Classification by Coordinate System – Cartesian , Cylindrical, Spherical and Jointed Arm Robots – Classification by Control Method – Non – servo controlled , Servo Controlled

, Point – to – point and Continuous path controlled robots –Major Components of a Robot – Robot specifications and Performance parameters – Accuracy – repeatability - Precision and Workvolumes of different robot geometries

UNIT – II

Kinematics of Robotic Manipulators – Kinematic links and joints – General description of robot manipulators – Homogeneous transformation (HT) of objects – Forward and Inverse kinematics of two – degrees – of – freedom (DOF) Planar manipulators – Robot hand – Roll – Pitch – Yaw (RPY) Transformations – Denavit – Hartenberg (DH) Representations – Kinematic solutions by DH matrix

UNIT – III

Mathematical Modelling of a Robotic system – Robot control system – Different types of controllers – On – off , Proportional, Integral, Derivative and PD and PID controllers – Control Systems – Closed – loop and Open – loop control systems – Transfer functions – Applications of transfer functions in the context of robot controllers

UNIT – IV

Robot Drives, Sensors and Grippers – Powering the manipulator – Hydraulic, Pneumatic and Electric Drives – Robot Sensors – Types – Position, velocity, force and tactile range and proximity sensors – Robot vision – Robot grippers – Types of end – effectors/grippers – mechanical, pneumatic and magnetic grippers

UNIT – V

Industrial Applications of Robots and Robot Programming – Applications – Material handling, Machine loading and unloading, Assembly and Inspection – Programming by teach box (or pendent) – On – line and offline programming methods – Robot workcells

TEXT BOOKS:

1. Mikell P. Groover, Mitchell Weiss, Roger N. Nagel and Nicholas G. Odrey, 'Industrial Robotics Technology, Programming and Applications', Mc Graw Hill Book company, 1986
2. Bernard Hodges, 'Industrial Robotics', Second Edition, Jaico Publishing House, 1993
3. Deb S.K, Deb.S,"Robotics Technology and Flexible Automation", Tata McGraw-Hill Education Private Limited, 2009.
4. Gonzalez K.S.F.U.R.C. and Lee C.S.G., Robotics – Control – Sensing, Vision, and Intelligence , Mcgraw-Hill Book Company (July 1987)
5. Paul R.P," Robot Manipulators: Mathematics, Programming and Control "The MIT Press (November 2, 1981)

REFERENCES:

1. John J. Craig, Introduction to Robotics Mechanics and Control, Second Edition, Addison Wesly Longman Inc. International Student edition, 1999
2. Mark W. Sponge & Vidya Sagar M.,"Robot Dynamics and Control",Wiley; 1st edition (1989)
3. Tsuneo Yohikwa, Foundations of Robotics Analysis and Control, Prentice Hall of India Pvt. Ltd., 2001

Department of Mechanical Engineering
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ME604E NC and CNC Systems

Credits: 3

Lectures/Week: 3 periods

Sessional marks: 20 +20
End Examination Marks: 60

UNIT-I

Introduction: Basic concepts of manufacturing systems, Fundamentals of machining Fundamentals of Numerical Control, Advantages of NC systems, Classification of NC systems, Features of NC machine tools and Design considerations of NC Machine Tools, Increasing productivity with NC Machines, Machine Control Unit Functions.

UNIT-II

NC Part Programming: Introduction, Manual programming- Basic concepts, Tape format, Contour Programming- Examples. Computer Aided Programming, APT Programming- General Description, Geometric Expressions, Motion Statements, Additional APT Statements-Examples, Other Programming Systems.

UNIT-III

System Devices: Drives-Hydraulic systems, Direct- Current Motors, stepping motors, Alternate-Current Motors. Feed Back Devices- Encoders, Resolvers, Inductosyn, Tachometers. Counting Devices-Flip- Flops, Counters, Decoders. Digital to Analog Converters.

Interpolators: Digital Differential Analyzer (DDA) – Principle of Operation, Exponential Deceleration, Linear Interpolator, Circular Interpolator, Complete interpolator, CNC Software Interpolators, Reference- word CNC Interpolators.

UNIT-IV

Control Loops: Introduction, Control of point to point systems- Incremental open-loop control, Incremental Closed loop control, Absolute closed loop circuit. Control loops in contouring systems- Principle of operation, position control, operation of a two-axis system.

CNC: Basic Concepts**,** Advantages of CNC, Digital Computer- principal structure, computer memory, Input and output, Reference-Pulse Technique, Microcomputers in CNC

UNIT-V

CNC Programming: – Steps in Programm planning, Part programming, preparatory commands, miscellaneous functions, input of dimensions, spindle and federate control, Tool functions and Reference points, Commands- register, position compensation, work offsets, tool length offset, rapid poisoning, machine zero, dwell.

CNC Turning, CNC Milling, and CNC Drilling- programme examples.

TEXT BOOKS:

Yoram Koren, "Computer Control of Manufacturing Systems", TATA McGraw-Hill, 2005. Peter Smid, "CNC Programming Handbook", second edition- Industrial Press Inc.

REFERENCES:

1. Steve F Krar, - Computer Numerical Control Simplified, Industrial Press,2001
2. Vishal S, "An introduction to NC/CNC machines", India 2013.
3. Agarwal P.M and Patel V.J., "CNC fundamentals and programming", Charotar Publishing House Pvt. Ltd.; 3nd Edition 2022
4. Radhakrishnan P., "Computer Numerical Control Machines", New central book agency,1992

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ME606L SIMULATION LABORATORY

Credits: 1.5

Laboratory/week: 3 hours

Internal Test: 40 Marks

End Examination: 60 Marks

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*(Note: Students shall carry out Any **8 from PART-A and 2 from PART-B** of the following exercises)*

PART-A

Modelling and simulation of functions of basic mechanical elements/process/systems

1. Numerical simulations and modeling of different manufacturing systems and processes using commercial software's, like ABAQUS, DEFORM, MATLAB etc.
2. Modelling of simple processes, like hardness testing, deflection of beam etc.;
3. Generation and distribution of stress during sheet and bulk forming processes;
4. Modelling of machining process (turning) and chip formation;
5. Modelling of heat transfer and temperature distribution during various thermal processes (heat treatment, metal cutting, non-conventional machining processes);
6. Network problem and CAPP problem solutions using MATLAB
7. Thermal stress simulation of a 2D component
8. Conductive/conductive heat transfer simulation of a 2D component

10 Mode frequency analysis of beams (Cantilever, Simply supported & Fixed ends) 11 Harmonic analysis of a 2D component

12 Simulations of deformations and equivalent strains in various bending operations

13 Simulations of deformations, equivalent strains and drawing forces in deep drawing operations

14 Simulations of deformations, equivalent strains and roller forces in roll forming operations

PART-B Manufacturing process Simulation

(Students shall carry out the modeling and simulation for case studies of the following)

1. Casting processes - Study of Solidification, temperatures, Residual stresses, metallurgical phases etc.
2. Forging processes - Study of cold working and hot working processes for extrusion, drawing, rolling, etc.
3. Forming Processes – Study of blanking, bending, deep drawing, etc.
4. Welding Processes – Study of arc, spot, laser welding, etc.

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ME607L DYNAMICS LABORATORY

Credits: 1.5

Laboratory/week: 3 hours

Internal Test: 40 Marks

End Examination: 60 Marks

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*(Note: Any **Eight** of the following exercises are to be performed)*

LIST OF EXPERIMENTS

1. Determination of Natural Frequency of Free Transverse Vibration
2. Cam Analysis – Cam Profile and Jump-speed Characteristics
3. Free Vibration of Spring Mass System – Determination of Natural Frequency
4. Compound Pendulum – Determination of Radius of Gyration and Moment of Inertia
5. Bifilar Suspension – Determination of Radius of Gyration and Moment of Inertia
6. Trifilar Suspension – Determination of Radius of Gyration and Moment of Inertia
7. Whirling of Shaft – Determination of Critical Speed
8. Balancing of Rotating Masses
9. Determination of Gyroscopic Couple
10. Experiments on centrifugal governors
11. Studies on Gear trains
12. Kinematic analysis of various mechanisms
13. Moment of inertia of flywheel & connecting rod

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ME608L METROLOGY LABORATORY

Credits: 1.5

Laboratory/week: 3 hours

Internal Test: 40 Marks

End Examination: 60 Marks

List of Experiments:

1. Measurement of Taper plug gauge using rollers, slip gauges and micrometer
2. Measurement of internal taper of a ring gauge using spheres and cylinders
3. Study of measuring instruments
4. Measurement of spur gear
5. Measurement of Taper ring gauge using spheres and depth micrometer
6. Sine Bar (Angle measurement of a Taper plug gauge)
7. Inspection of Drill Jig
8. Straightness testing – wedge Method
9. Measurement of Angle of V – Block
10. Measurement of Plug Screw by 3 – wire method
11. a) Measurement of effective diameter (Two – wire method) of a screw tap
    b) Radius measurement of a Partial cylinder

Mapping of Course Outcomes with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1			1	1					
CO2	2	1				1	1					
CO3		2		2		2						1
CO4			1	2			1					
CO5		1		2		3						

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ME609S CNC Programming

Credits: 2

Laboratory/week: 3 hours

Internal Test: 40 Marks

End Examination: 60 Marks

List of Experiments

*(Note: Any **Eight** of the following exercises are to be performed)*

1. Introduction to CNC.
2. G-Codes and M-Codes.
3. Outer diameter plane turning and Step turning operation.
4. Inner diameter Profile Turning and Threading operation.
5. Outer diameter Profile Turning and Grooving operation.
6. Drilling & Inner diameter Profile operation.
7. Face milling operation.
8. Profile milling operation using G40 method.
9. Profile milling operation using G41 method.
10. Profile milling operation using G42 method.
11. Drilling & Tapping operation.

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MC610A PROFESSIONAL ETHICS IN ENGINEERING

Instruction: Hours/Week: **2L:0T:0P** **Credits: 0**

Marks:100 Pre-requisites/co-requisites: None.

COURSE DESCRIPTION:

This course is designed to introduce engineering students to the concepts of engineering ethics. It will allow students to explore the relationship between ethics and engineering and apply classical moral theory and decision making to engineering issues encountered in academic and professional careers. It mainly focuses on improving the capacities of leadership /management through training in professional ethics. Codes of ethics have been invoked as a basis for professional engineering licensure. Violations of such ethical codes have led to many well-known tragic engineering failures that endangered human life and jeopardized public welfare. This discipline will doubtless take its place alongside such well- established fields as medical ethics, business ethics, and legal ethics.

COURSE OBJECTIVES: To enable the students

1. To create an awareness on Engineering Ethics and Human Values.
2. To instill Moral and Social Values and Loyalty and to appreciate the rights of others.
3. To study the moral issues and decisions confronting individuals and organizations engaged in engineering profession.
4. To study the related issues about the moral ideals, character, policies, and relationships of people and corporations involved in technological activity.

UNIT I Human Values: 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 – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II Engineering Ethics: 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: Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT-IV Safety, Responsibilities and Rights: Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) Discrimination.

UNIT V Global Issues: Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct – Corporate Social Responsibility.

COURSE OUTCOMES: Upon completion of the course, the student should be able to:

1. Discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.
2. Learn the moral issues and problems in engineering; find the solution to those problems.
3. Learn the need for professional ethics, codes of ethics and roles, concept of safety, risk assessment.
4. Gain exposure to Environment Ethics & computer ethics; know their responsibilities and rights.

Grading /Assessment:

(i). Attendance: 20 marks

(ii). Group Activities/Assignments: 20 marks (iii). Semester End Examination: 60 marks

TEXTBOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
5. Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility" Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.

Department of Mechanical Engineering
S. V. University College of Engineering:: TIRUPATI

ME701C- INDUSTRIAL ENGINEERING AND MANAGEMENT

EFFECTIVE FROM 2023-24 (R20- Regulations 2020)

Lectures/ Week : 3 Hours Tutorials/ Week : -

Credits: 3

COURSE OBJECTIVES:

- TO understand the concepts related to principles of management, Industrial disputes.
- To apply the concepts related to sales forecasting, PPC & work study.
- To understand the emerging concepts of Industrial Engineering for different applications.

CONTENTS:

UNIT–I

Management concepts:

Administration, Management and Organization. Scientific Management. Functions of Management. Principles of Management. Types of Organization. Principles of Organization. Fayol's and Taylor's contributions to Management.

Industrial disputes – Causes and methods of settling,Labour participation in management concept.A brief outline of Factories Act, Industrial disputes Act and Workmen's Compensation Act.

UNIT–II

Sales forecasting – need, Classification moving average exponential smoothing and linear regression technique.

Production Planning and Control – Objectives, Salient features and functions of PPC.

Personnel Management – A brief review of functions of personnel management. Concepts of job evaluation and merit rating

UNIT–III

Plant Location Layout – Location factors. Choice of city, Suburban and country locations. Plant Layout – Definition, Objectives, Salient features of product, process and fixed position layouts. Material Handling – Definition, Objectives, Classification of material handling equipment and factors influencing their selections

UNIT–IV

Work study – Definition, objectives and uses. Method study – definition.Objectives procedure and uses. Time study – Definition, needs, functions.

Basic concepts of break down, preventive, predictive and total productive maintenance.

UNIT–V

Contemporary Practices:

Basic concepts of Just-In-Time (JIT) System, Total Quality Management (TQM), Six sigma, Manufacturing Resource Planning (MRP-II), Enterprise Resource Planning (ERP), Business Process Re-engineering, 5S Model, Deming's PDCA, Kaizen, Poka-Yoke, Benchmarking.

TEXT BOOKS:

1. Khanna O P: Industrial Engineering And Management , 7th Edition, DhanpatRai& Sons, 2002
2. PannerSelvam R , Production and Operation Management
3. Ralph Barnes: Principles Of Motion And Time Study, Tata McGraw Hill, 1956
4. Joseph G Monks: Operation Management, 3rd Edition, McGraw-Hill, 1987

REFERENCES:

1. Adam &Edbert: Production/Operation Management, 5th Edition, Prentice Hall, 1992
2. Chary S.N.: Production and Operation Management,14th Reprint, Tata McGraw Hill, 2007
3. Buffa E S: Modern Production/Operation Management, 8th Edition, Wiley India, 2007
4. Clade S. George Jr : Management For Business Industry,1972

COURSE OUTCOMES: Upon completion of this course, students will be able to

DISCRIPTION OF THE COURSE OUTCOME	
CO1	Understand the principles of management and Industrial disputes.
CO2	Identify and design plant location, plant layout and material handling systems.
CO3	Apply forecasting and PPC techniques to production systems.
CO4	Reduce work duration in industries using work study.
CO5	Understand the contemporary concepts of Industrial Engineering.

Mapping of Course Outcomes with Program Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	2	-	1	2	2	2	2	1	1	2
CO2	2	1	2	2	2	2	2	2	2	1	1	1
CO3	2	1	2	-	2	2	2	2	2	1	1	2
CO4	2	1	2	3	2	2	2	2	2	1	1	1
CO5	2	1	2	1	2	2	2	2	2	1	1	3

Department of Mechanical Engineering
S. V. University College of Engineering:: TIRUPATI

ME702C- OPERATIONS RESEARCH

EFFECTIVE FROM 2023-24 (R20- Regulations 2020)

Lectures/ Week : 3 Hours Tutorials/ Week : -

Credits: 3

COURSE OBJECTIVES:

- To impart knowledge in concepts and tools of Operations Research.
- To understand mathematical models used in Operations Research.
- To apply these techniques constructively to make effective decisions.

CONTENTS:

UNIT–I

Development-definition-characteristics and phases-Types of models-Operations Research models-applications.

Allocation: Linear Programming Problem Formulation-Graphical solution- Simplex method-Artificial variable techniques: Two-phase method, Big-M method. Duality.

UNIT–II

Transportation problem: Formulation-Optimal solution, unbalanced transportation problem.

Assignment problem: Formulation- Optimal solution of Assignment problem- Travelling salesman problem.

UNIT–III

Sequencing: Introduction-Flow-Shop sequencing- n jobs through two machines – n jobs through three machines- Job shop sequencing-two jobs through 'm' machines

Replacement: Introduction- Replacement of items that deteriorate with time- when money value is not counted and counted- Replacement of items that fail completely- Group Replacement.

UNIT–IV

Theory of Games: Introduction- Terminology- Solution of games with saddle points and without saddle points. 2 x 2 games- dominance principle- m x 2 & 2 x n games- Graphical method.

Inventory models: Costs used in inventory models, Basic inventory models – deterministic and static demand.Models with price breaks - Models with restrictions. Single period models with probabilistic demand and without set up cost.

UNIT–V

Waiting lines: Introduction- Basic structure of queuing models, single server and multi server models.

PERT/CPM: Network Analysis, Program Evaluation and Review Technique (PERT), Critical Path Method (CPM).

TEXT BOOKS:

1. Vohra N. D.: Quantitative Techniques in Management, 3rd Edition, Tata McGraw Hill, 2007.
2. Pannerselvam R.: Operations Research, 2nd Edition, PHI, 2006.

REFERENCES:

1. Hamdy A Taha: Introduction to Operations Research, 6th Edition, PHI, 1999.
2. Hiller and Lieberman: Introduction to Operations Research, 7th Edition, McGraw Hill, 2001.
3. Hira and Gupta: Introduction to Operations Research, 3rd Edition, S. Chand & Company Limited, 2008.

COURSE OUTCOMES: Upon completion of this course, students will be able to

	DISCRIPTION OF THE COURSE OUTCOME
CO1	Understand the concepts of operations research modelling approaches and solve LP engineering problems.
CO2	Formulate and solve Transportation and Assignment problems relevant to different applications.
CO3	Able to apply replacement and game theory models for practical problems.
CO4	Able to Solve inventory problems.
CO5	Able to solve waiting line and Network problems.

Mapping of Course Outcomes with Program Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	2	2	1	1	-	-	-	-	1
CO2	3	2	2	2	2	1	1	-	-	-	-	2
CO3	3	2	2	2	2	1	1	-	-	-	-	2
CO4	3	2	2	2	2	1	1	-	-	-	1	1
CO5	3	2	2	2	2	1	1	-	-	-	1	1

Department of Mechanical Engineering
S. V. University College of Engineering:: TIRUPATI

ME703C AUTOMOBILE ENGINEERING

Credits: 3

Lectures/week: 3 Hrs. Sessional Marks: 20+20

End Examination Marks: 60

Unit-I

Introduction

Layout of automobile, Chassis and body – power transmission –types of engines, engine construction, turbo charging and super charging – **Lubrication System:** engine lubrication, splash and pressure lubrication systems, **Liners**- dry and Wet type, function and constructional details, **Combustion chambers:** combustion chambers for petrol and diesel engines, Arrangement of cylinders, types of valve arrangements, **Mufflers and Types**: Baffle type muffler, Wave cancellation type muffler.

Unit-II

Fuel Supply System:

Engine: Fuel supply systems, Mechanical and electrical fuel pump, carburetor: types, Air cleaners and types.

Engines: Requirements of diesel injection systems, types of injection systems, fuel pump.

Emission from Automobiles: Pollution standards National and international – Pollution Control, Techniques, Multipoint fuel injection system, Common rail diesel injection system, Gasoline direct injection system

UNIT III

Cooling System: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System, **Radiators**: Types, Cooling Fan, water pump, thermostat, antifreeze solutions.

Ignition System: Function of an ignition system, battery ignition system, constructional features of storage, battery, condenser and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker.

Electrical System: Charging circuit, generator, starting system, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT IV

Transmission Systems:

Clutch: Function of clutch, single plate and multiple plate, and centrifugal clutches and clutch materials, fluid coupling, torque converter.

Gear box: Need, sliding type, constant and synchromesh type. Automatic transmission. Propeller shaft; need and constructional details.

UNIT V

Suspension System: Objects of suspension systems – torsion bar, shock absorber.

Braking System: Mechanical brake system, Hydraulic brake system, Pneumatic and Vacuum brakes.

Steering System: Steering mechanism, Power Steering System, Ackerman steering mechanism, Davis steering mechanism.

TEXTBOOKS:

1. Automobile Engineering : Narang G.B.S.
2. Automobile Engineering Vol. I & II : Kirpal Singh.
3. Automobile Engineering : R.K. Rajput
4. Automobile Engineering : Dr. G. Devaradjane
5. Internal Combustion Engines : V. Ganesan
6. Internal Combustion Engines : K.K. Ramalingam
7. Automobile Engineering : P.S. Gill

REFERENCES:

1. Automotive Mechanics : Heitner J.
2. I.C.Engines : Mathur M.L. & Singh R.P.
3. Fundamentals of Motor Vehicle Technology : Hillier & Pittuck
4. High Speed Combustion Engines : Heldt P.M.
5. Automotive Mechanics Services : Course W.H.
6. Motor Manuals Vol. I to VII : Judge A.W.
7. Advanced Engine Technology : Heisler

Mapping of Course Outcomes with Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1			1						
CO2	1	1	2									
CO3		2				2	2	1				
CO4				1	2		2					
CO5			1		2	3	3					

Department of Mechanical Engineering
S. V. University College of Engineering:: TIRUPATI

ME704E Additive Manufacturing

Lectures/Week: 3 periods

Credits: 3

Sessional marks: 20 +20
End Examination Marks: 60

UNIT-I

Introduction: Basic Principles of Additive Manufacturing (AM), AM Parts, Generic AM Process, Use of term AM, Benefits of AM, Distinction Between AM and Conventional Manufacturing Processes, Examples of AM Parts, Classification of AM Processes, Heat Sources- Lasers, Electron Beam, Electric Arc/Plasma Arc. Milestones in AM Development, AM around the World and AM Standards

UNIT-II

AM Systems: Photopolymer-Based Systems, Powder-Based Systems, Molten Material Systems, Solid Sheets. Metal Systems - Use of Substrates, Energy Density, Weight, Accuracy, Speed, Build Rate. Maintenance of Equipment, Materials Handling Issues, Design for AM.

UNIT-III

Additive Manufacturing Processes: Photopolymerization, Powder Bed Fusion Material Extrusion, Material Jetting, Sheet Lamination, Directed Energy Deposition Direct

- Write technologies, Hybrid Additive Manufacturing.

UNIT-IV

Materials for Additive Manufacturing: Introduction, Liquid-Based Material, Support Material, Powder-Based Materials-Polymer Powder Material, Metal Powder Material, Ceramic Powder Material, Composite Powder for AM Processes, Solid-Based Materials, Material issues in AM. Guidelines for Process Selection, Challenges of Selection, Pre-Processing, Part Build Time, Post- Processing to Improve Surface Quality, Dimensional Deviations, Improve Mechanical Properties, Rapid Tooling

UNIT-V

AM Software: AM Software for STL Editing, Slicing, STL Manipulation, Process Visualization and Collision, Modeling and Simulation, Manufacturing Execution System Software for AM.
Applications: Application Areas for AM-Enabled Product Development, Medical Modeling, Reverse Engineering Data, Architectural Modeling, Automotive, Aerospace.

TEXT BOOKS:

Gibson Ian, David W. Rosen, Brent Stucker, and Mahyar Khorasani, "Additive Manufacturing Technologies", Springer, 2021.

REFERENCES:

1. A Practical Guide to Design for Additive Manufacturing, Diegel, Olaf, Axel Nordin, and Damien Motte, Springer, 2020.
2. The 3D Printing Handbook: Technologies, Design and Applications, Redwood, Ben, Filemon Schoffer, and Brian Garret, 3D Hubs, 2017
3. Design for Advanced Manufacturing: Technologies and Process, Laroux K, Gillespie, McGrawHill, 2017

Department of Mechanical Engineering
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ME704E Quality Control and Reliability

Lectures/Week: 3 periods

Credits: 3

Sessional marks: 20 +20

End Examination Marks: 60

Unit-I

Introduction to Inspection and Quality Control, Objectives of Statistical Quality Control, Chance and Assignable Causes of variation, Control chart basic principles, Choice of control limits, Sample frequency and rational subgroups.

Control charts for variables: X and R charts and σ charts, Interpretation of control charts.

Unit-II

Process Capability Analysis: Specification limits and Control limits, Natural tolerance limits, Specifications and Process Capability, Process Capability indices, setting tolerances on assemblies and components.

Control Charts for Attributes: P chart, C chart, U chart, Sensitivity analysis of P charts, Quality Rating System.

Unit-III

Acceptance Sampling Plans for Attributes: Types of Sampling Plans, Advantages and disadvantages of Sampling Plans, Evaluation of Sampling Plans – OC, Curve, Characteristics of OC Curve, Producer risk and Consumer risk, AOQ, AQL, ATI, ASN. Multiple and Sequential sampling plans. Brief introduction to Acceptance Sampling plans for continuous production and Acceptance sampling plan for variables.

Unit-IV

Reliability: Concepts of reliability, Scope, Importance of reliability, Reliability data collection- Failure data analysis: MTTF, MTBF, Failure rate, Hazard rate, reliability, Failure rate curve, Types of failures – Hazard models (Exponential and Weibull).

System Reliability: Series, Parallel and Mixed configurations.

Reliability Improvement: Active and Standby redundancies, Introduction to Fault Tree Analysis, Maintainability and Availability.

Unit-V

Quality Costs: Prevention, Appraisal, Internal failure and External failure costs, Quality and Productivity, Total Quality Management, Quality function deployment, Tools for continuous quality improvement. Quality Circles: Concepts, Objectives and advantages. Introduction to Six Sigma Concept. Features of ISO 9000 quality system- Classification, Need, advantages and limitations.

TEXT BOOKS:

1. Amitava Mitra, "Fundamentals of Quality Control and Improvement" Wiley publications, 3rd Edition, 2008.
2. Gupta, R.C., "Statistical Quality control", Khanna Publishers, 1997.

REFERENCES:

1. Besterfield D.H., "Quality Control– A Practical Approach", Prentice Hall, 1993.
2. Grant E.L. "Statistical Quality Control" McGraw-Hill Science/Engineering/Math; 7th - edition (1996):Srinath, L.S., "Reliability Engineering", Affiliated East west press

Department of Mechanical Engineering
S. V. University College of Engineering:: TIRUPATI

ME704E Refrigeration and Air – conditioning

Lectures/Week: 3 periods

Credits: 3

Sessional marks: 20 +20

End Examination Marks: 60

UNIT –I

Refrigeration: Cycles: Thermodynamic analysis of vapour compression, absorption, air cycle, steam jet and thermoelectric refrigeration systems. Comparison of COP and cost – Properties and selection of refrigerants – alternative refrigerants.

UNIT-II

Component parts: Reciprocating compressors – Condensers – Air cooled and Water cooled – Economical water rate – Evaporators – Defrosting – Design of towers and evaporative condensers.

UNIT-III

Refrigeration Control: Automatic and thermostatic expansion valve – Capillary tube – Compressor controls – miscellaneous controls. Testing and charging refrigeration units.

Cryogenics – liquification and purification of gases. Applications of refrigeration – dry ice, walk-in-Cooler, Water Coolers, Transportation, Food processing & Preservation, refrigerators, recent developments in refrigeration.

UNIT-IV

Air Conditioning: Basic Concepts : Fundamental functions of air conditioning – psychrometrics – air and humidity calculations – sensible heat factor – analysis of air conditioning process and cycles with psychrometric chart – Cooling load calculations.

UNIT-V

Comfort Air Conditioning: Physiological reactions to cooling – The effective temperature and its use in the determination of standards of comforts – comfort chart – comparison of domestic, industrial and commercial applications of air conditioning.

Ventilation system: Summer and winter ventilation – Ventilation of hot working spaces – industrial ventilation – air cleaning.

Controls: Automatic control of air conditioning systems – Duct work selection of fans.

TEXT BOOKS:

1. C. P. Arora: Refrigeration and Air Conditioning, 3rd Edition, McGraw-Hill, 2009
2. R. S. Agrarwal: Refrigeration and Air Conditioning, Allied Publishers, 2001.
3. Roy J. Dossat, "Principles of Refrigeration", 4th edition, Pearson Education Asia, 2009.
4. Stoecker, W.F. and Jones J. W., "Refrigeration and Air Conditioning", McGraw Hill, New Delhi, 1986.
5. Jones W.P., "Air conditioning engineering", 5th edition,Elsevier Butterworth-Heinemann, 2001

REFERENCES:

1. Hal Williams: Mechanical Refrigeration, 1st Edition, Whittaker & co., 1903.
2. Jordan & Priester: Refrigeration and Air Conditioning, 2nd Edition, Prentice-Hall, 1956.
3. Dossat: Principles of Refrigeration, 4th Edition, Pearson Education India, 2009.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2		3								
CO2		2	3									
CO3			2	3								
CO4		3	2	1								
CO5		3	2									

Department of Mechanical Engineering
S. V. University College of Engineering:: TIRUPATI

ME705E FINITE ELEMENT METHOD

Lectures/Week: 3 periods

Credits: 3

Sessional marks: 20 +20

End Examination Marks: 60

UNIT – I

Basic concepts of the Finite Element Method – Introduction, How does the FEM work – Comparison of Finite Element and Finite Difference Methods. A general procedure for Finite Element Analysis – Pre – processing, Solution and Post – processing. Brief History of Finite Element Method, Examples of Finite Element Analysis

UNIT – II

Stiffness Matrices – Spring and Bar Elements – Linear spring as a Finite Element – System Assembly in global coordinates, Elastic Bar, Spar/Link/Truss Element, Strain Energy, Castigliano's Theorem, Minimum Potential Energy

UNIT – III

Method of Weighted Residuals – Approximate Solution by Ritz, Galerkin Methods – Finite Element formulation of one – dimensional problems – Derivation of Element Stiffness and Element Force Matrices – Different Approaches in FEM**:** General Steps in FEM – Direct Approach- Variational Approach – Energy approach – Weighted Residual Approach. – Solving one – dimensional (1D) engineering problems and 1D heat transfer problems – fins

UNIT – IV

Flexural elements – Introduction, Elementary Beam theory, Flexural element, Flexural element stiffness matrix, Element load vector, Work equivalent for distributed loads, Hermite shape functions. 2D elements – liner triangular, bilinear rectangular and quadrilateral elements

UNIT – V

FEA of 2D structural and heat transfer problems, Constant strain triangle (CST), Jacobian, isoparameteric and serendipity elements – Numerical integration – Gauss Quadrature – Computer implementation in FEM

TEXTBOOKS

1. Fundamentals of Finite Element Analysis by David V. Hutton
2. A first course in the Finite Element Method by Daryl L. Logan
3. An Introduction to Finite Element Method by J.N. Reddy

REFERENCES

1. Introduction to Finite Elements in Engineering by Chandrupatla T.R. and Belegundu A.D
2. Finite element procedures by Klaus – Jurgen Bathe

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ME705E NANOTECHNOLOGY

Lectures/Week: 3 periods

Credits: 3

Sessional marks: 20 +20

End Examination Marks: 60

UNIT –I

General Properties of Nano materials: Origin of nanotechnology, classification of nano materials, Fullerene, Carbon Nanotubes (CNT). Nanoparticles, Physical, Chemical, Electrical, Optical, Magnetic and mechanical properties of nanomaterials.

UNIT-II

Fullerenes and Carbon Nanotubes (CNT's): Introduction, Synthesis and Purification, Preparation of Fullerenes in the condensed phase, Transport, mechanical, physical properties of CNT's. Investigating and manipulating materials in the Nanoscale – Electron microscope, scanning probe microscopes, optical microscopes for Nanoscience and Technology, X – Ray Diffraction.

UNIT-III

Nanobiology – Interaction between Biomolecules and Nanoparticle surgaces. Different types of Inorganic materials used for the synthesis of Hybrid Nano – Bio assemblies. Nanoprobes for analytical applications.

UNIT-IV

Nanosensors: Nanosensors based on optical properties. Nanosensors based on quantum size effects. Nanobiosensors.

Nanomedicines – Developments of nanomedicines, Nanotechnology in diagnostic applications, materials for use in Diagnostic and therapeutic applications.

UNIT-V

Fabrication of nano materials – Top down approach grinding, Planeterory milling and comparison of particles and bottom up approach – Wet chemical synthesis methods, Microemulsion approach, Colloidal Nanopartciles production, Sol Gel methods, Sonochemical approach, Microwave and automization, Chemical vapour deposition methods.

TEXT BOOKS:

1. T. Pradeep, Nano: The essentials, Tata MaGraw – Hill, 2008.
2. Sulabha K Kulkarni, Nanotechnology: Principles and Practices, Capital Publishing Company, 2007.
3. W.R. Fahrner, Nanotechnology and Nanoelectronics, Springer , 2006
4. Rechard Booker and Earl Boyssen, Nanotechnology, Willey, 2006.

Reference Books

1. Gabor L. Hornyak, H.F. Tibbalas, Joydeep Datta, John J Moore Introduction to Nanoscience and Nanotechnology CRC Press.

Department of Mechanical Engineering
S. V. University College of Engineering:: TIRUPATI

***ME 705E* MECHANIACAL VIBRATIONS**

EFFECTIVE FROM 2022-23 (R20- Regulations 2020)

Lectures/ Week : 3 Hours Tutorials/ Week : - Credits: 3

COURSE OBJECTIVES:

- To study the basics of the vibrations of system.
- To deal with study and analysis of vibration phenomenon, control of vibration in machine parts, balancing.
- To deal with Introduction of basic terminology of noise engineering and noise control.

CONTENTS:

UNIT – I

Oscillatory motion – Harmonic motion and periodic motion – conservation of energy and Newton's second law.Theory of the single degree – of – freedom oscillator – Free vibrations – Forced vibrations – Harmonic excitation. The undamaped system – The damped system.

UNIT – II

Free vibration with viscous damping – Forced vibration with viscous damping – Logarithmic decrement – response to simple forcing functions – Steady – state response to sinusoidal forcing – Properties of the dynamic amplification factor (DAF).

UNIT – III

Vibration of two – degree – of – freedom system – free response of an undamped 2 – DOF system – Use of Rayleigh's method and fundamental natural frequency – Natural frequency and mode shape shapes of undamped spring – mass system.

UNIT – IV

Normal mode analysis of undamped multi – degree – of – freedom system – Orthogonality properties of an undamped multi – degree – of – freedom system – Orthonormal modes. Decoupling forced vibration equations – Modal damping forced vibrations.

UNIT – V

Vibration of continuous systems – Vibrating string – Longitudinal vibration of rods – Torsional vibration of rods. Approximation methods in vibration analysis.

TEXT BOOKS

1. W.T. Thomson and M.D. Dahleh, Theory of vibration with applications, Pearson Education, Inc, 2007.
2. Max Irvine, Structural dynamics, Allen and Unwin, 1980

REFERENCE BOOKS

1. Denhartog Mechanical Vibrations, John Wiley and Sons, 2008.
2. Benson H. Tongue, Principles of vibration, 1st Edition, ASME, 1993.

COURSE OUTCOMES: Upon completion of this course, students will be able to

	DISCRIPTION OF THE COURSE OUTCOME
CO1	Understand the different types of vibratory systems and solve for the natural frequency of a freely vibrating 1-DOF systems.
CO2	Analyze the responses of different vibratory systems
CO3	Analyze the vibration of 2-DOF systems.
CO4	Analyze the vibration of Multi-DOF systems.
CO5	Conduct the analysis of vibration of systems.

Mapping of Course Outcomes with Program Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	3	2	2	1	2	2	-	-	-	-	-
CO2	2	2	2	2	1	1	-	-	-	-	-	-
CO3	2	2	2	2	1	1	-	-	-	-	-	-
CO4	2	3	2	2	1	1	-	-	-	-	-	-
CO5	2	2	2	2	1	2	2	-	-	-	-	1

Department of Mechanical Engineering
S. V. University College of Engineering:: TIRUPATI

ME705E COMPOSITE MATERIALS

Lectures/Week: 3 periods

Credits: 3

Sessional marks: 20 +20
End Examination Marks: 60

UNIT – I

Basics of Composites

Introduction: Definition, Classification of Composite materials based on structure, based on matrix, Advantages of composites, Applications of composites, Functional requirements of reinforced and matrix.

UNIT – II

Manufacturing Methods

Open moulding methods Hand – lay up process, Spray – lay up process, Filament winding process Closed moulding methods: Compressive moulding, Vacuum bag moulding, pultrusion process and resin transfer moulding process.

UNIT – III

Types of reinforcements and their properties: Fibers: Carbon, Boron, Glass, Aramid, Al_2O_3, SiC, Nature and Manufacture of glass, Carbon and aramid fibers, Comparison of fibers.

UNIT – IV

Fabrication of Polymeric Matrix Composites, Structure and Properties of Polymeric Matrix Composites Interface in Polymeric Matrix Composites, Applications.

Fabrication of Metal Matrix Composites: Solid state fabrication, Liquid state fabrication and In – situ fabrication techniques.

UNIT – V

Micromechanics of Composites: Density, Mechanical Properties: Prediction of Elastic constants, Micromechanical approach. Halpin – Tsai Equations, Transverse stresses

TEXTBOOKS

1. Composite Materials – Science and Engineering, K.K. Chawla, Springer – Verlag, NewYork, 1987
2. An introduction to Composite Materials, Hull, Cambridge, 2nd Edition, 1997
3. A textbook of Manufacturing Technology: Manufacturing Processes by R.K. Rajput, 2nd Edition
4. Fracture Mechanics by C.H. Wang , Airframes and Engines Division Aeronautical and Maritime Research Laboratory

Department of Mechanical Engineering
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ME707S ROBOT PROGRAMMING

Lectures/week: 1 hours — Credits: 02

Laboratory/week: 2 hours* — Continuous Assessment: 40

End Examination: 60

***Evaluation is similar to regular Practical/Laboratory Class Model/Pattern**

UNIT – I

Types of robots based on mode of control – PTP (point – to – point) and Control and Continuous path (CP) control robots.

Trajectory planning of a robot and its importance in execution of programming commands in accomplishing the given task in the world environment

UNIT – II

Robot Programming Methods – Broad classification – Online and Offline Programming

Types of programming – Manual setup – lead through programming – Computer like robot programming languages – Off line programming.

UNIT – III

Lead through programming – Powered lead through and Manual lead through – Use of Teach box or Control box in Manual programming of a robot – A robot simulator for lead through teaching

General information required or provided for teaching a robot

UNIT – IV

Robot Programming Languages – VAL, AL , and AML – Features and Applications

UNIT – V

Programming a robot in a work cell or robot cell and in Machine Vision environment

Sample Exercises/Experiments**

1. Program for PNP (Pick and Place) Activity
2. Teaching a robot to pick an object that is moving on a chute
3. Program for palletize the object
4. AL for bolt insertion task
5. Training a robot in accomplishing loading and unloading tasks in a robot or work cell
6. Programming a robot in a work cell aided by vision system
7. Programming to ensure safety of a robot in a work cell
8. Programming a robot to perform assembly and handling tasks in a robot cell

References

1. Mikell P. Groover, Mitchell Weiss, Roger N. Nagel and Nicholas G. Odrey, 'Industrial Robotics Technology, Programming and Applications', Mc Graw Hill Book company, 1986
2. Bernard Hodges, 'Industrial Robotics', Second Edition, Jaico Publishing House, 1993
3. Deb S.K, Deb.S,"Robotics Technology and Flexible Automation", Tata McGraw-Hill Education Private Limited, 2009.

** ***Additions and deletions may be permitted in the above list of experiments depending on the availability of training or technical expert.***

Department of Mechanical Engineering
S. V. University College of Engineering:: TIRUPATI

ME508S FINITE ELEMENT ANALYSIS

Lectures/week: 1 hours — Credits: 02

Laboratory/week: 2 hours* — Continuous Assessment: 40

End Examination: 60

***Evaluation is similar to regular Practical/Laboratory Class Model/Pattern**

Course Outcomes (COs):

CO 1 Able to understand the basic concepts of FEA
CO 2 Able to understand spring , line, quadratic bar and plane truss elements
CO3 Prepared to model and formulate the given physical problem by suitable Finite Elements
CO4 Ability to make use of the numerical power of MATLAB in solving the FEA problems

UNIT – I

Introduction –Steps of the Finite Element Analysis (FEA) – MATLAB Functions for FEA – Overview of MATLAB – The spring Element Basic Equations – MATLAB Functions Used – Practice Exercises

UNIT – II

The Linear Bar Element – Basic Equations – MATLAB Functions Used – Practice Exercises

UNIT – III

The Quadratic Bar Element – Basic Equations – MATLAB Functions Used – Practice Exercises

UNIT – IV

The Plane Truss Element – Basic Equations – MATLAB Functions Used – Practice Exercises

UNIT – V

The Beam Element – Basic Equations – MATLAB Functions Used – Practice Exercises

TEXTBOOKS

1. Fundamentals of Finite Element Analysis by David V. Hutton
2. Concepts and Applications of Finite Element Analysis by Robert D. Cook, David S. Malkus and Michael

   E. Plesha

3. MATLAB Guide to Finite Elements – An interactive Approach by Peter I. Kattan
4. A first course in the Finite Element Method by Daryl L. Logan
5. An Introduction to Finite Element Method by J.N. Reddy

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MC 509A Universal Human Values

Instruction: Hours/Week: **2L:0T:0P** **Credits: 0**
Marks:100 Pre-requisites/co-requisites: None.

COURSE DESCRIPTION:

The methodology of this course is universally adaptable, involving a systematic and rational study of the human being vis-à-vis the rest of existence. It is free from any dogma or value prescriptions. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with and within the student himself/herself finally.

COURSE OBJECTIVES:

1. To develop a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. To understand (or developing clarity) the harmony in the human being, family, society and nature/existence.
3. To strengthen self-reflection and to develop commitment and courage to act.
4. To understand social responsibility of an engineer.
5. To appreciate ethical dilemma while discharging duties in professional life.

COURSE CONTENT:

UNIT I: Introduction - Need, Basic Guidelines, Content and Process for Value Education: Purpose and motivation for the course, Self-Exploration–what is it? - Its content and process; „Natural Acceptance" and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly - A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

UNIT II: Understanding Harmony in The Human Being - Harmony in Myself! :

Understanding human being as a co-existence of the sentient „I" and the material „Body". Understanding the needs of Self („I") and „Body" - happiness and physical facility (Sukh and Suvidha). Understanding the Body as an instrument of „I" (I being the doer, seer and enjoyer). Understanding the characteristics and activities of „I" and harmony in „I". Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Health.

UNIT III: Understanding Harmony in The Family and Society- Harmony in Human-Human Relationship: Understanding harmony in the Family - the basic unit of human interaction. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness (Ubhay-tripti); Trust **(Vishwas)** and Respect **(Samman)** as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution (Samadhan), Prosperity (Samridhi), fearlessness (**Abhay**) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha) - from family to world family.

UNIT IV: Understanding Harmony in The Nature and Existence - Whole Existence as Coexistence: Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

UNIT V: Implications of The Above Holistic Understanding of Harmony on Professional Ethics: Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics:

a. Ability to utilize the professional competence for augment
b. ting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations.

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

1. To become more aware of themselves, and their surroundings (family, society, nature)
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
3. Understand the role of a human being in ensuring harmony in society and nature.
4. To become sensitive to their commitment towards what they have understood (human values, human relationship and human society)
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

TEXT BOOKS:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.

REFERENCE BOOKS:

1. E. F. Schumancher, 1973, Small is Beautiful: a study of economics as if people mattered. Blond & Briggs, Britain.
2. A. N. Tripathy, 2003, Human Values, New Age International Publishers.
3. Ivan IIIich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
4. A Nagraj, 1998 Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
5. Sussan George, 1976, How the Other Half Dies, Penguin Press, Reprinted 1986, 1991.
6. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
7. E G Seebauer & Robert L.Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
8. M Govindrajan, S Natrajan & V. S Senthil kumar, Engineering Ethics (including Humna Values), Eastern Economy Edition, Prentice Hall of India Ltd.
9. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
10. India Wins Freedom - Maulana Abdul Kalam Azad.

Relevant CDs, Movies, Documentaries & Other Literature:

1. value Education website, http://www.uptu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. AI Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charle Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology - the Untold Story.