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

SRI VENKATESWARA UNIVERSITY: TIRUPATI
SRI VENKATESWARA UNIVERSITY COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING

Course

B.Tech MECHANICAL ENGINEERING

Choice Based Credit System (CBCS)

Academic Year 2017-2018

Department of Mechanical Engineering
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VISION AND MISSION OF MECHANICAL ENGINEERING DEPARTMENT

VISION:

To be a globally renowned center for quality education and innovative research in Mechanical Engineering

MISSION:

M1	Prepare effective and responsible graduate engineers for global requirements.
M2	Continuously strive to improve pedagogical methods employed in delivering the academic programs.
M3	Respond dynamically to the changing requirements of the industry.
M4	Conduct basic and applied research to contribute to intellectual human capital.
M5	Inculcate the spirit of entrepreneurship and social responsibility.

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 engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modernengineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions 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 multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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Curricular Components
Degree Requirements for B. Tech in Mechanical Engineering

Category of Courses	CreditsOffered	Credits to be earned
Basic Science Core (BSC)	17	17
Engineering Science Core (ESC)	36	36
Humanities and Social Science Core (HSC)	09	09
Fundamental Course Core and Elective (FCCE)	17	17
Programme Core Courses (PCC)	93	93
Departmental Elective Courses (DEC)	06	06
Open Elective Courses (OPC)	06	06
Programme Major Project (PMP)	08	08
EAA: Games and Sports	00	00
Total	**192**	**192**

Audit Courses:

- Every student has to take two audit courses during his/her study of B. Tech Programme.
- I opined that these non – credit courses for the Mechanical Students should be of the following types: ***Industrial Tour (IT) and Personality development (PD).*** Preferably non – engineering courses.
- Preferred semesters for offering these courses could be IV and VI semesters respectively.

Foundation Courses: (list of probables)

- ICT (Information and Communication Technology) – Foundation Core Course (FCC)
- Communication Skills – FCC
- Environmental Sciences – Foundation Elective Course (FEC)
- Engineering Ethics – FEC
- Analytical Skills – FEC
- Entrepreneurship – FEC
- Leadership Education – FEC

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First Year B. Tech – 1st Semester

Sl. No	Course Code	Name of the Course	Category	Scheme of Instructions Hours per week				Credits
				Lecture	Tutorial	Practical	Drawing	
01	MAT01	Engineering Mathematics – I	BSC	03	02			04
02	CST01	Computer programming	FCC	03	02			04
03	CET01	Environmental Studies	FEC	02	02			03
04	PHT01	Engineering Physics	BSC	03				03
05	CYT01	Engineering Chemistry	BSC	03				03
06	MET01	Engineering Graphics	ESC	02			03	04
07	CSP01	Computer Programming Lab	FCC			03		02
08	MEP 01	Workshop Practice	ESC			03		02
10		**Total**		**16**	**06**	**06**	**03**	**25**

BSC – Basic Science Core: 10 Credits;
ESC – Engineering Science Core: 06 Credits;
FCC – Foundation Core Courses: 06 Credits;
FEC – Foundation Elective Course: 03 Credits

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First Year B. Tech – 2nd Semester

Sl. No	Course Code	Name of the Course	Category	Scheme of Instructions Hours per week				Credits
				Lecture	Tutorial	Practical	Drawing	
01	MAT02	Engineering Mathematics – II	BSC	03	02			04
02	CST02	Data Structures	FCC	03	02			04
03	EET01	Basic Electrical Engineering	ESC	03				03
04	ECT01	Basic Electronics Engineering	ESC	03				03
05	CET41	Engineering Mechanics	ESC	04				04
06	ENT01	English	HSC	03				03
07	CSP02	Data Structures Lab	FCC			03		02
08	ENP 01	English Communication Lab	HSC			03		02
10		**Total**		**19**	**04**	**06**		**25**

BSC – Basic Science Core: 04 Credits;
ESC – Engineering Science Core: 10 Credits;
FCC – Foundation Core Courses: 06 Credits;
HSC – Humanities and Social Science Core: 05

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Second Year B. Tech – 1st Semester

Sl. No	Course Code	Name of the Course	Category	Scheme of Instructions Hours per week				Credits
				Lecture	Tutorial	Practical	Drawing	
01	MAT03	Mathematics – III	BSC	03				03
02	CET42	Mechanics of Solids	ESC	04				04
03	FEC01	Professional Ethics	FEC	02				02
04	MET02	Thermodynamics	PCC	04				04
05	MET03	Advanced Engg. Graphics	ESC	02			03	04
06	MET04	Manufacturing Processes	PCC	04				04
07	CEP41	Mechanics of Solids Lab	ESC			03		02
08	MEP02	Manufacturing Processes Lab	PCC			03		02
09		**Total**		**19**		**06**	**03**	**25**

Note: The courses on "Professional Ethics" and "Environmental Studies" can be treated as Foundation Elective courses.

Hence, total number of Foundation Courses for B. Tech (Mechanical Engineering) is "proposed" to be four i.e., "two foundation core courses and two foundation elective courses".

BSC – Basic Science Core: 03Credits;
ESC – Engineering Science Core: 10 Credits;
FEC – Foundation Elective Course :02 Credits
PCC – Programme Core Course: 10 Credits

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Second Year B. Tech – 2nd Semester

Sl. No	Course Code	Name of the Course	Category	Scheme of Instructions Hours per week				Credits
				Lecture	Tutorial	Practical	Drawing	
01	EOT01	Managerial Economics	HSC	02				02
02	MET05	Kinematics of Machinery	PCC	04				04
03	MET06	Thermal Engineering	PCC	04				04
04	MET07	Machine Tools and Metal Cutting	PCC	04				04
05	CET43	Fluid Mechanics and Hydraulic Machinery	ESC	04				04
06	MET08	Machine Drawing	PCC	01			03	03
07	CEP42	Fluid Mechanics and Hydraulic Machinery Lab	ESC			03		02
08	EEP43	Electricals Engineering Lab	ESC			03		02
09	ECP42	Electronics Engineering Lab	ESC			03		02
10		**Total**		**19**		**09**	**03**	**27**

PCC – Programme Core Courses: 15 Credits;
ESC – Engineering Science Core: 10 Credits;
HSC – Humanities and Social Science Core: 02

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Third Year B. Tech – 1st Semester

Sl. No	Course Code	Name of the Course	Category	Scheme of Instructions Hours per week				Credits
				Lecture	Tutorial	Practical	Drawing	
01	COT02	Managerial Accountancy	HSC	02				02
02	MET09	Mechanical Measurements and Metrology	PCC	03				03
03	MET10	Dynamics of Machinery (DOM)	PCC	04				04
04	MET11	IC Engines and Gas Turbines	PCC	04				04
05	MET12	Materials Science and Metallurgy	PCC	04				04
06	MET13	Design of Machine Members – I	PCC	04				04
07	MEP03	Machine Tools Lab	PCC			03		02
08	MEP04	Fuels Lab	PCC			03		02
09		**Total**		**21**		**06**		**25**

PCC – Programme Core Courses: 23 Credits;
HSC – Humanities and Social Science Core: 02;

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Third Year B. Tech – 2nd Semester

Sl. No	Course Code	Name of the Course	Category	Scheme of Instructions Hours per week				Credits
				Lecture	Tutorial	Practical	Drawing	
01	MET14	Refrigeration and Air – Conditioning	PCC	03				03
02	MET15	Operations Research	PCC	04				04
03	MET16	Design of Machine Members – II	PCC	04				04
04	MET17	Industrial Engineering and Management	PCC	03				03
05	MEOE	Open Elective – I (OPE – I)	OPC	03				03
06	MEDE	Departmental Elective – I (DPE-I)	DEC	03				03
07	MEP05	IC Engines Lab	PCC			03		02
08	MEP06	Metrology Lab	PCC			03		02
09		**Total**		**20**		**06**		**24**

PCC – Programme Core Courses: 18 Credits;
OPC – Open Elective Course : 03 Credits;
DEC – Departmental Elective Course: 03 Credits;

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Fourth Year B. Tech – 1st Semester

Sl. No	Course Code	Name of the Course	Category	Scheme of Instructions Hours per week				Credits
				Lecture	Tutorial	Practical	Drawing	
01	MET18	Analysis and Control of Production Systems	PCC	03				03
02	MET19	Tool Design	PCC	04				04
03	MET20	Automobile Engineering	PCC	03				03
04	MET21	Finite Element Method	PCC	04				04
05	MET22	Heat Transfer	PCC	04				04
06	MEOE	Open Elective – II (OPE II)	OPC	03				03
07	MEP07	Heat Transfer and Dynamics Lab	PCC			03		02
08	ECP43	MATLAB	PCC			03		02
09		**Total**		**21**		**06**		**25**

PCC – Programme Core Courses: 22 Credits;
OPC – Open Elective Course: 03 Credits;

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Fourth Year B. Tech – 2nd Semester

Sl. No	Course Code	Name of the Course	Category	Scheme of Instructions Hours per week				Credits
				Lecture	Tutorial	Practical	Drawing	
01	MET23	CAD/CAM	PCC	03				03
02	MEDE	Departmental Elective II (DPE II)	DEC	03				03
03	MEP08	CAD/CAM Lab	PCC			03		02
04		Minor project	PMP					02
05		Major Project	PMP		03	03		06
06		**Total**		**06**	**03**	**06**		**16**

PCC – Programme Core Courses: 05 Credits;
DEC – Departmental Elective Course: 03 Credits;
PMP – Programme Major & Mini Projects : 08 Credits;

Open Electives (OPEs) under Mechanical Engineering Stream –I

1) Project Management
2) Green Energy Systems
3) Industrial Robotics

Open Electives (OPEs) under Mechanical Engineering Stream –II

1) Quality Control and Reliability Engineering
2) Power Plant Engineering
3) Engineering System Analysis and Design

Semester – wise Grouping of Departmental Electives (DPEs)

Semester	Departmental Electives (DPEs)
VI	1) Mechanical Vibrations 2) Advanced Manufacturing Processes 3) Non – conventional Energy Sources
VIII	1) Mechatronics 2) Robotics 3) Nanotechnology

Electives Codes – For Open Electives – MEOE 01, …..
For Departmental Electives – MEDE 01,….

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

Year	Semester		Credits
First	First Semester	25	50
	Second Semester	25	
Second	First Semester	25	52
	Second Semester	27	
Third	First Semester	25	49
	Second Semester	24	
Fourth	First Semester	25	41
	Second Semester	16	
Total	**Eight Semesters**		**192**

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MAT01 ENGINEERING MATHEMATICS – I

Instruction Hours / Week : 5 **Credits: 4**

Common to all branches and with effect from 2016-17

Course Objective:

- To gain the knowledge of mathematics & Engineering problems
- To model a wide range of engineering and practical problems as ordinary differential equations
- To train the students thoroughly in Mathematical concepts of ordinary differential equations, multiple integrals, Laplace Transforms and their applications.
- To prepare students for lifelong learning and successful careers using mathematical concepts of ordinary differential equations, multiple integrals, Laplace Transforms and their applications.
- To develop the skill pertinent to the practice of the mathematical concepts including the student abilities to formulate and modeling the problems, to think creatively and to synthesize information.

Unit – I

Differential Equations: Linear differential equations of second and higher order with constant coefficients-particular integrals-homogeneous differential equations with variable coefficients-method of parameters-simulation equations.

Unit – 2

Laplace Transforms I: Laplace transforms of standard functions-inverse transforms-transforms of derivatives and integrals-derivatives of transforms-integrals of transforms.

Unit – 3

Laplace Transforms II: Transforms of periodic functions-convolution theorem-applications to solution of ordinary differential equations.

Unit – 4

Calculus: Roll's and Mean value theorems - Taylor's and Maclaurins's series-maxima and minima for functions of two variables - Infinite series - Convergence Tests series of positive terms - comparison, Ratio tests - Alternating series - Leibnitz's rule - Absolute and conditional convergence.

Unit – 5

Multiple Integrals: Curve tracing (both Cartesian and polar coordinate) - Evaluations of double

and Triple integrals-change of order of integrations-change of variables of integrations-simple applications to areas and volumes.

Text Books:

1. B S Grewal, Higher Engineering Mathematics, 40th Edition, Khanna Publications, 2007.
2. M K Venkataraman, Engineering Mathematics, National Publishing Company, Chennai.
3. B V Ramana, Higher Engineering Mathematics, 6th Reprint, Tata McGraw-Hill, 2008.
4. Bali and Iyengar, Engineering Mathematics, 6th Edition, Laxmi Publications, 2006.

COURSE OUTCOME:

CO1	Applying various statistical models and methods for drawing conclusions and making decisions under uncertainty in engineering contexts
CO2	Apply statistical and numerical methods in various computer science related projects, seminars and research
CO3	Apply the knowledge of iterative methods to solve algebraic and transcendental equations, simultaneous linear equations, ODE (ordinary differential equations)
CO4	Acquire knowledge of finite differences, interpolation, numerical differentiation and numerical integration
CO5	Demonstrate a basic knowledge of the techniques for accurate and efficient solution of models based on linear and nonlinear systems of equations, ordinary differential equations and partial differential equations.

Mapping of Course Outcomes with Program Outcomes:

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

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CST01 COMPUTER PROGRAMMING

Instruction Hours / Week : 5 **Credits: 4**

Common to all branches and with effect from 2016-17

Course Objective:

- To understand the core aspects of computer problem solving techniques
- To understand the various concepts of C language such as branching, loops, functions, input/output, expression evaluation, arrays, pointers and files.
- To apply the syntax of control and looping statements
- To understand the programming language constructs
- To understand the programming paradigms

UNIT – I

Introduction to Programming– Problem Solving Steps, SDLC, Algorithms, and flow charts.

Common features of C and C++ Programming Languages – Identifiers, Variables, Constants,data types, Operators and Expressions, Input / Output operations.Statements- Decision Making, Branching and Looping, continue, go to and break.Precedence and Associatively, Expression Evaluation, Type conversions.C and C++ Simple Programming examples

UNIT – II

Arrays and Strings – Concepts, arrays, one and two and multidimensional arrays.Strings Handling: String Input / Output functions, arrays of strings, string manipulation functions, data conversion, C and C++ Simple Programming examples

Designing Structured Programs- Functions- basics, functions, Scope, Storage classes- auto, register, static, extern, scope rules, type qualifiers, recursion, Preprocessor directives.

Derived types – Structures – Declaration, definition and initialization of Structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bit fields, enumerated types.C and C++ Simple Programming examples

UNIT – III

Pointers – Introduction, Pointers for inter function communication, pointers to pointers, compatibility, memory allocation functions, array of pointers, pointers to void, pointers to functions, command –line arguments. C and C++ Simple Programming examples

Data File Handling: Input and Output– Concept of a file, streams, standard input / output

Functions, formatted input / output functions, text files and binary files, file input / output operations, file status functions (Eq.error handling), C and C++ Simple Programming examples.

Dynamic Memory Allocation: Allocating a Block and Multiple Blocks, releasing the used space and altering memory size. C and C++ Simple Programming examples

UNIT – IV

Basics of Object Oriented Programming (OOP) and **C++:** BenefitsofOOP, datatypes, declarations, expressions and operatorprecedence,scope ofvariables

Introductionto OOP and Concepts: Abstraction**,** Data hiding, Encapsulation Classesand objects, Constructors&Destructors,Operator overloading&type conversions.

Polymorphism: Pointers, virtualfunctions andpolymorphism- pointers to objects,thispointer, pointers to derived classes, virtual and purevirtualfunctions,C++ Simple Programming examples

UNIT – V

Inheritance: Derived classes, syntax of derived classes, making privatemembers inheritable, single, multilevel,multiple, hierarchical, hybridinheritance.

Templates, Exception handling,consoleI/Oand FileI/O:classtemplates,Function templates, member functiontemplates, exception handling, managing console I/Ooperations, working with files. Programming guide lines and Simple C++ Programming examples

Course Outcome:

CO1	Graduates will possess knowledge on mathematics, science and fundamental engineering concepts.
CO2	The ability to design and develop applications, as well as to analyze and interpret data.
CO3	The ability to function on multi-disciplinary areas and will be able to demonstrate with excellent programming, analytical, logical and problem solving skills.
CO4	Graduates will demonstrate with an ability to develop, test and debug the software.
CO5	Graduates will demonstrate with an ability to deploy, analyze, troubleshoot, maintain, manage and secure the computer network.

TEXT BOOKS:

1. Scheldt H, C: The Complete Reference, 4th Edition, Tata McGraw-Hill, 2002.
2. Balagurusamy E, Programming in ANSI C, 4th Edition, Tata McGraw-Hill, 2008
3. Robert Lefore, Object Oriented Programming in C++, 4th edition, PEARSON Education

4. Scheldt H , C++ : The Complete Reference, Tata McGraw-Hill

REFERENCES:

1. C Programming with problem solving, J.A. Jones & K. Harrow, dreamtech Press
2. Programming in C – Stephen G. Kochan, III Edition, PearsonEductaion.
3. C for Engineers and Scientists, H.Cheng, Mc.Graw-Hill International Edition
4. Data Structures using C – A.M.Tanenbaum, Y.Langsam, and M.J.Augenstein, Pearson Education / PHI
5. C Programming & Data Structures, P. Dey, M Ghosh R Thereja,Oxford University Press
6. C & Data structures – E V Prasad and N B Venkateswarlu, S.Chand& Co
7. Kernighan and Ritchie, The C programming language (2nd edition). Prentice Hall of India, 1988.
8. Coohoon and Davidson, C++ Program Design: An introductionto Programming and Object-Oriented Design. Tata McGraw Hill3rd edition. 2003.
9. G. Dromey, How to Solve it by Computer, Prentice-Hall Inc.,Upper Saddle River, NJ, 1982.Yashwant Kanetkar, Let's C, Allied Publishers, 1998.
10. Programming in C, PradipDey, ManasGhosh, Second Edition, OXFORD

Mapping of Course Outcomes with Program Outcomes:

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

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CET01ENVIRONMENTAL STUDIES

Instruction Hours / Week :4 **Credits: 3**

Common to all branches and with effect from 2016-17

Course Objective:

- To understand the impacts of developmental activities and mitigation measures along with the environmental policies and regulations.
- To recognize major concepts in environmental studies and demonstrate in-depth understanding the environment.
- To implement scientific, technological, economic and political solutions to environmental problems.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management
- To know about global environmental problems like Acid Rains, Global Warming, Green House Effects, Ozone layer depletion.

Unit I **Environmental Studies and Natural Resources**

Definition, Scope and importance of Environment, Environmental studies, Need for public awareness

Components of Environment- Atmosphere, Hydrosphere, Lithosphere.

Renewable and **Non Renewable Resources and associated problems**

- Water resources: Use and over utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.
- Forest resources: Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Land resources: Land as a resource, land degradation, Man induced landslides, soil erosion and desertification.
- Mineral resources: Use and overexploitation, Environmental effects of extracting and using mineral resources, case studies.
- Food resources: World food problems, changes caused agriculture and overgrazing, effects of modern agriculture, fertilizer – pesticide problems, water logging, salinity, Case studies.
- Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.
- Role of an individual in conservation of natural resources.

Unit II **Ecosystem and Biodiversity :**

Ecosystem - Concept of an ecosystem.

1. Structure and functions of an ecosystem.
2. Producers, consumers and decomposers.
3. Energy flow in the ecosystem.

4. Ecological succession.
5. Food chains, food webs and ecological pyramids.
6. Introduction, types, characteristic features, structure and function of the following ecosystem.
   (a) Forest ecosystem. (b) Grassland ecosystem
   (c)Desert ecosystem. (d) Aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation:

- Definition, genetic species and ecosystem diversity.
- Biogeographically classification of India.
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation.
- Hot-spots of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man – wildlife conflicts.
- Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

Unit III Environmental pollution and Global Effects.

- Definition, Causes, Effects, and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards
- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution.
- Pollution case studies.
- Disaster management: Floods, earthquakes, cyclone, landslides, Tsunami.
- Climate change-Global warming, Acid rain, Ozone depletion,.

Unit IV Environment Issues and Management

- Environment and Human health – Epidemic diseases, HIV/AIDS, Aviation Flue, Water Borne Diseases.
- Environmental Impact Assessment, Sustainable Development, Clean Production and Clean Development Mechanisms
- Environment Legislation: Environmental Protection Act, Water Act, Air Act, Wild Life Protection Act, Forest Conservation Act, Public Liability & Insurance Act, Issues involved in Enforcement of Environmental legislation.

Unit V Social Issues and the Environment

- Population growth, Population Explosion, Population Control, Women and Child welfare.
- Urbanization, Industrialization, Development projects, Resettlement and Rehabilitation of people – Problems concerned, Case studies.
- Consumerism and Waste Products Conservation, Public Awareness, Water Conservation, Rain water harvesting, watershed management, Wasteland reclamation, Human Rights, Value education, Environmental ethics- Issues and possible solution.
- Role of information Technology in Environment and Human Health.

Course Outcome:

CO1	Able to understand the importance of the environment
CO2	Able to identify conservation concepts of natural resources
CO3	Able to identify problems due to human interactions in the environment
CO4	Able to understand the enforcement of environment acts in our constitution
CO5	Capable of managing social issues related to environment

Text books :

1. AnubhaKaushik& C P Kaushik, Environmental studies, New age International Publishers, 2008
2. Benny Joseph, Environmental studies, Tata McGraw-Hill Publishers, 2005
3. M Chandra Sekhar, Environmental Science, Hi-Tech Publishers, 2004
4. Keerthinarayana and Daniel Yesudian, Principles of Environmental Sciences and Engineering , Hi-Tech Publishers, 2005
5. AmalK.Datta, Introduction to Environmental Science and Engineering, Oxford & IBH Publishing Co.Pvt.Ltd, 2000
6. SanthoshkumarGarg,RajeshawriGarg and RajniGarg, Ecological and Environmental studies, Khanna publishers, 2006

Reference books:

1. Gilbert M, Introduction to Environmental Engineering and Science, Masters Publication by Prentice –Hall of India Private Ltd., 1991

2. William P Cunningham and Mary Ann Cunningham, Principles of EnvironmentalScience, Tata McGraw Hill Publishing Co.Ltd, 2002

Mapping of Course Outcomes with Program Outcomes:

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

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PHT01 ENGINEERING PHYSICS

Instruction Hours / Week : 3 **Credits: 3**

Common to all branches and with effect from 2016-17

Course Objective:

- To learn and understand the basic concepts of quantum mechanics and the merits and demerits of classical and quantum free electron theory.
- To develop interest on various phenomenon of light waves like interference, diffraction, amplification of light through stimulated emission, propagation of light with engineering applications.
- To understand the arrangement of atoms, direction, planes in crystals, structure of crystals and application of ultrasonic.
- To recognize the mechanism of superconductors and magnetic materials, their properties and applications
- To acquire knowledge in understanding semiconductors, basic concepts and significance of nonmaterial's, their synthesis and applications & understanding semiconductor based electronic devices, basic concepts and applications of semiconductors & magnetic materials have been introduced which find potential in the emerging micro device applications.

UNIT-I

Crystallography : Unit Cell – Bravais Lattice – Crystal systems – Crystal packing – Close Packed Structures – NaCl, ZnS and Diamond – Miller Indices – Bragg`s Law –Bragg`s Spectrometer and Crystal Structure determination – Defects in crystal Structure – Point Defects and Line Defects .

UNIT – II

Quantum Mechanics : Wave – Particle duality – de Broglie Concept of Matter Waves – Properties of Matter Waves – Davison and Germer Experiment – G.P.Thomson Experiment – Heisenberg's Uncertainty Principle – Schrödinger's Time Independent and Time Dependent Wave equation – Significance of Wave Function – Electron in an Infinite Square Potential Well – Probability Densities and Energy Levels.

UNIT – III

Band Theory of Solids : Classical Free Electron Theory of Metals – Success and Failures – Quantum

Free Electron Theory – Fermi Factor – Electron in Periodic Potential – Bloch Theorem – Kronig – Penney Model – Distinction between Metals , Insulators and Semiconductors – Intrinsic and Extrinsic Semiconductors – Hall Effect.

UNIT – IV

Lasers : Introduction – Spontaneous and Stimulated emissions – Population Inversion – Types of Lasers – Ruby Laser – He-Ne Laser – Semiconductor Laser – Applications of Lasers.

Ultrasonics : Introduction – Production of Ultrasonic Waves by Magnetostriction and Piezoelectric methods – Detection and Applications of Ultrasonic Waves.

UNIT – V

NanoPhysics and Nanotechnology : Introduction to Nanomaterials –Properties: Optical Properties – Quantum Confinement – Electrical properties. Synthesis of Nanomaterials: Ball milling, Arc deposition method – Chemical Vapour Deposition-Pulsed laser deposition. Characteristics of C^{60} (Zero dimensional), Carbon Nanotubes (One Dimensional) and Graphene(Two Dimensional). Applications of Nanomaterials.

Course Outcome:

CO1	Students demonstrate appropriate competence and working knowledge of laws of modern physics in understanding advanced technical engineering courses.
CO2	Ability to understand the crystal geometries and estimation of crystal structure by X-ray diffraction techniques.
CO3	Students demonstrate the ability to identify and apply appropriate analytical and mathematical tools of physics in solving engineering problems.
CO4	Student's ability to understand the principles in the production and applications of lasers and their effective utilization in optical communication and detection.
CO5	Students poses the ability to understand size depended properties of nano dimensional materials and their effective utilization in making nano and micro devices for further microminiaturization of electronic devices.

Text Books:

1. R.K.Gaur and S.L.Gupta ``Engineering Physics" Sultan and Chand Pub., New Delhi
2. S.P.BasavaRaju `` A Detailed Text Book of Engineering Physics" Sole Distributers, Subhash Stores Book Corner, Bangalore
3. HitendraK.Malik and A.K.Singh ``Engineering Physics" Tata MCGraw Hill Education PVt.Ltd., New Delhi
4. G.Senthil Kumar, `` Engineering Physics'' VRH Publishers Pvt. Ltd, Hyderabad
5. M.S.RamachandraRao and Shubra Singh, ``Nanoscience and Nanotechnology`` Wiley India Pvt.Ltd, New Delhi.

Refrence Books

6. John Allison, ``Electronic Engineering Materials and Devices" Tata McGraw Hill Publications.
7. B.L Theraja, "Modern physics", S.Chand& Company.
8. V. Raghavan "Material Science", Tata McGraw Hill Publications

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
S. V. University College of Engineering:: TIRUPATI

CYT01 ENGINEERING CHEMISTRY

Instruction Hours / Week : 3 **Credits: 3**

Common to all branches and with effect from 2016-17

Course Objective:

- The Engineering Chemistry course for undergraduate students is framed to strengthen the fundamentals of chemistry and then build an interface of theoretical concepts with their industrial/engineering applications
- To study the effect of hard water and its treatment for various purposes, corrosion and control of metallic materials,
- To study the engineering materials such as high polymers namely plastics, rubbers and their preparation, properties and applications along with lubricants, refractories with its applications.
- To study the calorific value of fuels, combustion of fuels, working of batteries, recharging of batteries, application of different fuel cells
- The lucid explanation of the topics will help students understand the fundamental concepts and apply them to design engineering materials and solve problems related to them. An attempt has been made to logically correlate the topic with its application.

UNIT-I:

WATER TREATMENT: Introduction – Effect of water on rocks and minerals – hardness of water – disadvantages of hard water – boiler feed water – scale and sludge formation in boilers – caustic embrittlement – boiler corrosion – priming and foaming – softening methods-lime soda, zeolite and ion exchange process-Specification of potable water and purification of Drinking water – chemical analysis of water-Hardness, acidity, alkalinity, chloride and dissolved oxygen.

UNIT –II:

ELECTRO CHEMISTRY AND CORROSION: Electrode potential – reference electrodes – hydrogen, calomel and glass electrode – PH and its determination –batteries – fuel cells – aluminum air battery – solar battery – lead acid storage cell.-Corrosion: Types of corrosion – factors influencing corrosion – theories of corrosion – prevention of corrosion – cathodic protection – metallic coatings – hot dipping, spraying, cementation, cladding and electro plating.

UNIT –III:

FUELS AND COMBUSTION: Introduction – classification of fuels – calorific value and its

determination – bomb calorimeter – Boy's gas calorimeter – theoretical calculation of calorific value of fuel – coal – analysis of coal – metallurgical coke – petroleum –refining of petroleum- synthetic petrol – octane and cetane number– combustion – mass analysis from volume analysis and vice versa – analysis of flue gas by Orsat's apparatus.

UNIT –IV:

HIGH POLYMERS: Nomenclature of polymers – types of polymerization-Plastics – classification of plastics – moulding constituents of plastics– preparation, properties and applications of polythene, nylon, Teflon, and bakelite – Rubbers – vulcanization of rubber –compounding of rubber- synthetic rubbers-buna-N, thiocol and silicon rubbers- Lubricants-classification-mechanism-properties of lubricating oils-selection of lubricants for engineering applications.

UNIT–V:

BUILDING MATERIALS: Manufacture-dry and wet processes-setting and hardening of cement-analysis of cement. Refractories-classification-properties and engineering applications. Ceramics-classification-properties and engineering applications

Course Outcome:

CO1	Students acquire the knowledge of with the preparation of various colloidal systems.
CO2	Students will understand different principles involved in electrochemical processes and their importance in industry like electro deposition and electroplating etc.,
CO3	Students will be able to understand different types of corrosion methods and their impact in metallic industry, boilers and furnaces.
CO4	Students will be able to learn different types of hardness and its disadvantages in daily life and in industry.
CO5	It provides the classification and some polymerization methods

Books Recommended:

1. Engineering Chemistry : PC Jain & M Jain-Dhanpatrai publishing company, New Delhi

2. Engineering Chemistry : BK Sharma

3. Engineering Chemistry : SS Dhara

4. Physical Chemistry : Puri& Sharma-Vishal Pulishing Company(VPC), Jalandhar

5. Physical Chemistry : Bahl&Tuli-

6 Polymer Science- :Gowarikar-

7 Physical Chemistry by: Glasstone-

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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MET 01 ENGINEERING GRAPHICS

Lecture/Hours per week: 02 hrs
Drawing/week: 03 hrs

Credits: 04
Sessionals: 20+20
End Semester Exam: 60

Course Objective:

- This course will introduce students to Engineering Drawing and build their ability to read drawings and interpret the position and form of simple geometry, culminating into understanding of simple technical assemblies.
- To gain and understanding of the basics of geometrical constructions of various planes and solids, understanding system of graphical representation of various objects and various views to draft and read the products to be designed and eventually for manufacturing applications
- To familiarize the students in basic concept of conic sections, projections and developments of Objects.
- To impart knowledge about standard principles of orthographic projection of objects.
- To draw sectional views and pictorial views of solids.

UNIT-I

Scales, plane scale, diagonal scale Practices
Conics- construction of Ellipse, parabola and Hyperbola by eccentricity method
Ellipse- Concentric circles and Oblong methods, Rectangular hyperbola

UNIT-II

Construction of cycloidal curves- epi cycloid and hypocycloid, Involutes- Circle, Polygon

UNIT-III

Projection of points-Principles of Projections, First and Third angle projections, projections of points
Projection of Lines- Projection of straight Lines, lines inclined to one plane and parallel to the other, Lines inclined to both planes, True length and true inclinations, Location of traces

UNIT-IV

Projection of Plane surfaces and solids-Projection of Polygonal surfaces and circular lamina inclined to both planes. Projection of right regular solids- Projection of simple solids such as Prisms, Pyramids,

Cylinders and Cones with their axes perpendicular to anyone of the Principal planes and inclined to the other.

UNIT-V

Section of Solids- Sections of above solids in simple vertical position resting on their base, by cutting planes inclined to one reference plane and perpendicular to the other-True shape of the sections.
Orthographic Projections- Conversion of Pictorial views into orthographic views of simple objects.

Course Outcome:

CO1	Able to Select, Construct and Interpret appropriate drawing scale as per the situation.
CO2	Able to draw simple curves like ellipse, cycloid and spiral.
CO3	Able to draw projections of points and lines in any direction of plane.
CO4	Able to draw projections of planes and solids in any direction of a plane.
CO5	Draw orthographic projection of solids like cylinders, cones, prisms and pyramids including sections.

Text Books:

1. **Bhatt N.D. and V.M. Panchal,** Engineering Drawing Revised Edition, Charotar Publications, 2001.
2. **Dhananjaya A Jolhe,** Engineering Drawing with an introduction to Auto CAD, Tata MeGrawhill - 2009
3. **K.L.Narayana and P. Kannaih,** A text Book of Engineering Drawing, Scitech Publications – 1999.
4. **Venugopal,K.,** Engineering Drawing and Graphics, New Age International Publishers

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						

Department of Mechanical Engineering
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CSP01 COMPUTER PROGRAMMING LAB

Instruction Hours / Week : 3 **Credits: 2**

Common to all branches and with effect from 2016-17

Course Objective:

- To make the student solve problems, implement algorithms using C language.
- To make the student solve problems, implement those using C & C++ programming languages.
- To strengthen the ability to identify and apply the suitable data structure for the given real world problem
- To organize the user's data for decision making and iterative processes.
- To apply structured programming approach to solve real time applications.

Syllabus

1. **C and C++ Programming Languages shall be used for Implementation of the following Programs.**

2. **The following List is not exhaustive, The instructor changes the problems and number of programs for continuous evaluation Teaching Learning Process**

Week-1
1) Write a C program to make the following exchange between the variables a-> b -> c->d - > a
2) Write a C program to carry out the arithmetic operations addition, subtraction, multiplication, and division between two variables
3) Write a C program for printing prime numbers between 1 and n.

Week-2
1) Write a C program to construct a multiplication table for a given number.
2) Write a program to reverse the digit of a given integer.
3) Write a C program to find the sum of individual digits of a positive integer.
4) Write a C program to calculate the factorial of a given number

Week-3
1) Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

2) Write a program to calculate tax, given the following conditions:
   a) If income is less than 1, 50,000 then no tax.
   b) If taxable income is in the range 1,50,001 – 300,000 then charge 10% tax
   c) If taxable income is in the range 3,00,001 – 500,000 then charge 20% tax
   d) If taxable income is above 5,00,001 then charge 30% tax

Week-4
Write a program to print the calendar for a month given the first Week- day of the month.

Input the first day of the month (Sun=0,Mon=1,Tue=2,Wed=3,.....) :: 3
Total number of days in the month : 31
Expected output

Sun	*Mon*	*Tue*	*Wed*	*Thu*	*Fri*	*Sat*
-	-	-	*1*	*2*	*3*	*4*
5	*6*	*7*	*8*	*9*	*10*	*11*
12	*13*	*14*	*15*	*16*	*17*	*18*
19	*20*	*21*	*22*	*23*	*24*	*25*
25	*26*	*27*	*28*	*29*	*30*	*31*

2) Write a C program to find the roots of a quadratic equation

Week-5

1) Write a program to print the Pascal triangle for a given number
2) Write a C program to find the GCD (greatest common divisor) of two given integers
3) Write a C program to construct a pyramid of numbers.
4) Write C code to define a function cash_dispense, which takes an amount as its input, and returns the number of 1000, 500, 100, 50, 20, 10, 5, 2, 1 rupee denomination that make up the given amount

Week-6

1) Write C code to reverse the contents of the array. For example, [1,2,3,4,5] should become [5,4,3,2,1]
2) Write a C program that uses functions to perform the following:
   i) Addition of Two Matrices

   ii) Multiplication of Two Matrices

3) Write a program that will search and find out the position where the given key element exist in a user chosen array and print it as output.

Week-7

1) Write C code to compute the frequency table of survey responses given by 20 users. The survey responses range from 1 to 5 and are stored in an array. For example, 10 responses are stored in the array [1,1,5,2,3,3,5,5,2,2]. The frequency table will be as shown below:
   a. 1 = 2
   b. 2 = 3
   c. 3 = 2
   d. 4 = 0
   e. 5 = 3
2) Write a program to define a function to sort an array of integers in ascending order by using exchange sort.

Week-8
1) Write a C program to check whether a given string is a palindrome or not, without using any built-in functions.
2) Write a C program to determine if the given string is a palindrome or not by using string functions.
3) Write a function that accepts a string and delete the first character.
4) Write a function that accepts a string and delete all the leading spaces.

Week-9 Write a program to accept a string from user and display number of vowels, consonants, digits and special characters present in each of the words of the given string.

Week-10
1) Write a C program to define a union and structure both having exactly the same numbers using the sizeof operators print the sizeof structure variables as well as union variable
2) Declare a structure *time* that has three fields *hr, min, secs.* Create two variables,*start_time*and*end_time.* Input there values from the user. Then while *start_time* is not equal to *end_time* display GOOD DAY on screen.

Week-11
1) Write a program to read in an array of names and to sort them in alphabetical order. Use sort function that receives pointers to the functions strcmp, and swap, sort in turn should call these functions via the pointers.
2) Write a program to read and display values of an integer array. Allocate space dynamically for the array using the *malloc()*.
3) Write a program to calculate area of a triangle using function that has the input parameters as pointers as sides of the triangle.

Week-12
1) Two text files are given with the names text1 and text2. These files have several lines of text. Write a program to merge (first line of text1 followed by first line of text2 and so on until both the files reach the end of the file) the lines of text1 and text2 and write the merged text to a new file text3.
2) Write a program to split a given text file into n parts. Name each part as the name of the original file followed by .part<**n>** where n is the sequence number of the part file.

Course Outcome:

CO1	The ability to design and develop applications, as well as to analyze and interpret data.
CO2	Graduates will be able to demonstrate with excellent programming, analytical, logical and problem solving skills.
CO3	Graduates will demonstrate with an ability to develop, test and debug the software.
CO4	Graduates will demonstrate with an ability to deploy, analyze, troubleshoot, maintain, manage and secure the computer network.
CO5	Graduates will be able to communicate effectively in both verbal and written forms.

Reference Books:

1. Computer Science, A Structured Programming Approach Using C by Behrouz A. Forouzan& Richard F. Gilberg, Third Edition, Cengage Learning
2. C Programming A Problem-Solving Approach, Behrouz A. Forouzan& E.V. Prasad, F. Gilberg, Third Edition, Cengage Learning
3. Programming with C RemaTheraja, Oxford
4. "C Test Your Skills", Kamthane, Pearson Education
5. Programming in C: A Practical Approach, Ajay Mittal, Pearson
6. Problem solving with C, M.T.Somasekhara, PHI
7. C Programming with problem solving, J.A. Jones & K. Harrow,Dreamtech Press

Programming withc, Byron S Gottfried, Jitender Kumar Chhabra, TMH,2011

Mapping of Couse Outcomes with Program Outcomes:

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

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MEP 01 WORKSHOP PRACTICE

Practicals per week: 03 hrs

Credits: 02
Sessionals: 20+20
End Semester Exam: 60

Course Objective:

- To understand the basic tools and operations in carpentry
- To understand the basic tools and operations in fitting & various types of joints.
- To understand the basic tools and operations in sheet metal trades.
- To understand the basic tools of house wiring & house wiring connections etc.
- To understand the basic tools and manufacturing processes in a foundry trade

Carpentry

Wood sizing exercise in planning, marking, sawing, chiseling and grooving to prepare

1. Half – lap joint
2. Dove – tail joint
3. Mitred Mortise and Tenon joint

Fitting

Markings, cutting and filing to prepare

1. Straight fitting
2. V – fitting
3. Square fitting

Tin smithy

Markings, bending and cutting to prepare

1. Round tin
2. Square tin
3. Truncated Prism

Foundry

Ramming and placing of riser and runner to prepare the moulds for the following

1. Two – stepped pulley

2. Three – stepped pulley
3. Dumbell

Electrical Wiring

1. One light controlled by one switch in parallel
2. Two lights controlled by one way switch in series

Course Outcome:

CO1	Design and develop different types of wood joints based on the requirement
CO2	Design and develop different types of fittings as per requirement
CO3	Able to develop prototype models by using tin smithy too1ls.
CO4	Design and develop different moulds as per practical requirements.
CO5	Able to connect bulbs either series or parallel

Mapping of Course Outcomes with Program Outcomes:

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

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MAT02 ENGINEERING MATHEMATICS – II

Instruction Hours / Week : 5 **Credits: 4**

Common to all branches and with effect from 2016-17

Course Objective:

- This course will illuminate the students in the concepts of liner algebra.
- To introduce the vector methods and vector calculus in evaluating multiple integrals in two and three dimensional spaces.
- To equip the students with standard concepts of Fourier series and harmonic analysis and their applications.
- To familiarize the students with the techniques of evaluating improper integrals.
- To provide knowledge on Legendre's polynomials and properties of Bessel's functions.

Unit – 1

Matrices: rank of a matrix-solution of system of linear equations-eigenvalues,vectors-cayley-hamilton theorem-quadratic forms-diagonalization.

Unit – 2

Vector Calculus: Gradient, Divergence, Curl of a vector and related properties-line, surface, volume integrals- Green's, Stokes's and Gauss Divergence theorems and its applications.

Unit – 3

Fourier Series: Fourier series-even and odd functions, periodic functions-half range sine and cosine series-harmonic analysis.

Unit – 4

Special Functions I: Gamma and Beta functions-series solutions of differential equations-ordinary points.

Unit – 5

Special Functions II: Bessel function-recurrence formulae-generating function for $J_n(X)$-Lengender polynomials-recurrence formulae-generating function for $P_n(X)$ - Rodrigue's formula - orthogonality of Lengender polynomials.

Course Outcome:

CO1	Use ranks of matrices to decide whether the system of linear equations is consistent or not and hence solve.
CO2	Acquire knowledge about the physical interpretation of the gradient, divergence and curl.
CO3	Able to know the basic results about the properties of Fourier transform and Fourier series and its convergence.
CO4	Acquire the knowledge of properties of special functions and to use this to solve differential equations.
CO5	Able to generate the functions of Lengender polynomials.

Text Books:

1. B S Grewal, Higher Engineering Mathematics, 40th Edition, Khanna Publications, 2007.
2. M K Venkataraman, Engineering Mathematics, National Publishing Company, Chennai.
3. B V Ramana, Higher Engineering Mathematics, 6th Reprint, Tata McGraw-Hill, 2008.
4. Bali and Iyengar, Engineering Mathematics, 6th Edition, Laxmi Publications, 2006.

Mapping of Course Outcomes with Program Outcomes:

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

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CST02 DATA STRUCTURES

Instruction Hours / Week : 5 **Credits: 4**

Common to all branches and with effect from 2016-17

Course Objective:

- To provide the knowledge of basic data structures and their implementations.
- To choose the appropriate data structure and algorithm design method for a specified application.
- To efficiently implement the different data structures and solutions for specific problems.
- To solve problems using data structures such as linear lists, stacks, queues, binary trees, binary search trees, and graphs and writing programs for these solutions.
- To develop skills to apply appropriate data structures in problem solving and allow to assess how the choice of data structures and algorithm design methods impacts the performance of programs.

UNIT I

Definitions of Data structures, Storage Structures and File Structures.Primitive and Non-primitive Data Structures, Linear and Nonlinear Data Structures.
Performance Analysis, Asymptotic Notation and Performance Measurement.
Linear Lists - ADT, Array Representation, Linked Representation and applications.

UNIT II

Stacks: Definition, The Abstract Data Type, Array Representation, Linked Representation. Queues: Definition, The Abstract Data Type, Array Representation, Linked Representation, Circular Queues, Applications. Linked Lists: Single Linked Lists – Insertion and Deletion, Double Linked Lists – Insertion and Deletion.

Skip List and Hashing: Dictionaries, the ADT of Skip List, Linear List Representation, Hash Table Representation.

UNIT III

Binary Trees - Definition and Properties, ADT, Array Representation, Linked Representation, and Applications.Heap- Definition and Applications.

Binary Search Trees - Definition, ADT, Implementation and Applications.

Introduction to Balanced Search Trees - AVL Trees, Red-Black Trees, and Splay Trees.

UNIT IV

Graphs - Definition and Properties, Modeling Problems as Graphs, ADT, Representations, Breadth First Search and Depth First Search.Priority Queues: Definition and Applications, Single and Double Ended Priority Queues, Linear Lists, Heaps, Leftist Trees, Binomial Heaps, Fibonacci Heaps, Pairing Heaps

Introduction to Algorithms for Solving Problems: Minimum Spanning Tree, Single Source Shortest Paths, All-Pairs Shortest Paths, and Maximum Flow.

UNIT V

Efficient Binary Search Trees: Optimal Binary Search Trees, AVL Trees, Red – Black Trees, Splay Trees. Multiway Search Trees: m – way Search Trees, B – Trees, B+ - Trees

External Searching -Concepts of Simple Indexing, Multilevel Indexing, B- Trees, B+ Trees, Static Hashing, Collision Resolution Techniques, Packing Density, Bucket Size and Extendible Hashing.

Course Outcome:

CO1	Understand various algorithms for searching and sorting
CO2	Design and implement data structures like arrays, stacks & queues
CO3	Learning to use singly/doubly linked lists for efficient implementation of data structures
CO4	Understanding the tree data structure, with focus on binary trees, binary search trees and height-balanced trees
CO5	Understand data structures such as minimum spanning trees and graphs and also their applications in real world scenarios

Text Books:

1. Sahni S, Data Structures, Algorithms and Applications in C++, 2nd Edition, Universities Press, 2005.
2. Malik D S, Data Structures using C++, Cengage Learning, 2003.
3. Fundamentals of Data Structures in C++ by Ellis Horowitz, SartajSahni, Dinesh Mehta, Universities Press, Second Edition.

REFERENCES:

1. Data Structures and Algorithms Using C++ by AnandaRaoAkepogu and RadhikaRajuPalagiri
2. Classic Data Structure by D. Samanta, Eastern Economy Edition.
3. Data Structures and Algorithms Made Easy by NarasimhaKarumanchi, Second Edition, Written

in C/C++, CareerMonk Publications, Hyderabad
4. ADTs, Data Structures and Problem Solving with C++, Larry Nyhoff, Pearson
5. Data Structures using C++, D.S.Malik, 2nd Edition, Cengage Learning
6. Data Structures through C++, YashavantP.Kanetkar, BPB Publication
7. Data Structures using C and C++, YedidyahLangsam.MosheJ.Augenstein Aaron M.Tenenbaum, 2nd Edition,PHI
8. Data Structures using C & C++, Rajesh K.Shukla, Wiley-India
9. Tremblay J P and Sorenson P G, Introduction to Data Structures with Applications, 2nd Edition, McGraw-Hill, 1984.
10. Cormen T H, Leiserson C E, Stein C, and Rivest R L, Introduction to Algorithms, 2nd Edition, Prentice Hall of India, 2007.
11. Folk M J, Riccardi G, and Zoellick B, File Structures-An Object-Oriented Approach with C++, Pearson
12. T.H.Cormen, C.E.Leiserson, R.L.Rivest, C. Stein, Introduction to Algorithms, 2nd edition, Prentice-Hall India, 2001
13. J. Kleinberg and E. Tardos, Algorithm Design, Pearson International Edition, 2005.
14. Data Structures Using C and C++ YddishLangsam, Moshe J. Augenstein and Aaron M. Tanenbaum, Prentice Hall Of India (2nd Edition) (Chapters 1 to 8)

Mapping of Course Outcomes with Program Outcomes:

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

EET01 BASIC ELECTRICAL ENGINEERING

Instruction Hours / Week : 3 **Credits: 3**

Common to Civil, Mechanical, Chemical branches and with effect from 2016-17

Course Objective:

- To introduce the concepts of electrical circuits and its components
- To understand magnetic circuits, DC circuits and AC single phase & three phase circuits
- To study and understand the different types of DC/AC machines and Transformers.
- To import the knowledge of various electrical installations.
- To introduce the concept of power, power factor and its improvement.

UNIT-I

Basic Circuit Concepts: Basic circuit elements R, L and C—Classification of circuit elements, voltage and current sources—Kirchoff's laws—Star-delta and Delta to Star transformations, Network reduction techniques, Simple problems

UNIT-II

DC Circuits: DC Circuit analysis by mesh current method and Nodal voltage method, Superposition theorem, Thevenin's theorem and maximum power transfer theorem –Application to simple DC circuits

UNIT-III

AC Circuits: Average value—RMS value—form factor, crest factor---j-notation, Phasor diagrams, reactance, impedance and admittance, active power, reactive power, apparent power , power triangle.—Expression for real power in ac circuit—Analysis of simple---series and parallel circuits

UNIT-IV

DC Machines: Principle of operation of dc generator, emf equation, types of generators, principle of operation of dc motor, Back EMF, torque equation of dc motor, Illustrative examples, applications dc motors

UNIT-V

Transformers: Single phase transformer –principle of operation—types of transformers—emf equation, transformer on load

Induction Motors: principle of operation of 3-phase induction motor, types of 3-phase induction

motorsPrinciple of single phase induction motor, types , applications of 3-phase and single phase induction motors

Illuminations: Introduction, Laws of Illumination, Lighting calculations, Design of lighting schemes

Course Outcome:

CO1	Demonstrate and able to explain electrical components, electrical circuits and Kirchoff's laws.
CO2	Acquire knowledge of DC circuit analysis, DC network theorems and their applications
CO3	Formulate and solve complex AC, DC circuits.
CO4	Understand the principles of operation of DC machines, single phase transformers and three phase induction motors
CO5	Identify the starting methods of starting synchronous and induction motors and speed control methods for DC motors

Text Books:

1. Network analysis by A Sudhakar, ShyamMohan (Tata McGrawHill)
2. Basic Electrical Engineering by DP Kothari, IH Nagrath (Tata McGrawHill)

References:

1. Electrical Technology – E. Hughes (University Press)
2. Electrical Circuits – Joseph Edminister (TMH Series)

Mapping of Course Outcomes with Program Outcomes:

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

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

ECT01 BASIC ELECTRONICS ENGINEERING

Instruction Hours / Week : 3 **Credits: 3**

Common to Civil, Mechanical, Chemical branches and with effect from 2016-17

Course Objective:

- To gain knowledge of the basic principles of electronic circuits operation.
- To introduce the concepts of diodes & transistors, and to impart the knowledge of various configurations, characteristics and applications.
- To introduce the students about domestic wiring, the functioning of various electrical apparatus and the safety measures. Emphasize the effects of electric shock and precautionary measures.
- To impart basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
- To introduce the concepts of generators, motors, transformers and their applications. Students equipped with the knowledge and training provided in the course will be able to participate in design, development and operation in the different area of electronics system.

UNIT-I

Electronics Devices: Introduction to electronics, review of p-n junction operation, diode applications, Zener diode as regulator, Transister – Biasing, characteristics, FET-Operation, Types of FETs, Photo Electronic Devices.

UNIT-II

Amplifiers and applications: Transistor Amplifier, Amplifier characteristics, Simple RC coupled amplifier and frequency response. Cascaded amplifiers, FET Amplifier, Oscillator principle, LC and RC oscillators.

UNIT-III

Digital Circuits: Number systems, Conversion of number systems, Logic gates, Boolean theorems, Demorgan theorems, combination logic circuits, Flip-Flops, Counters and Shift Registers, Data converters, ADC and DAC convertors

UNIT-IV

Instrumentation: Measurements, Errors in measurements, Cathode Ray oscilloscope, Measurements using CRO – Voltage, Current, Frequency, Time and Phase angle, Transducers, Strain gauges, LVDT, Temperature measurements.

UNIT-V

Principles of Communication: Basic Communication system, Need for Modulation, Types of Modulation, AM Modulation and Demodulation, FM Modulation and Demodulation, Sampling Theorem, Pulse Modulation, Digital Modulation Techniques.

Course Outcome:

CO1	Characterize semiconductors, diodes, transistors and operational amplifiers
CO2	Acquire the knowledge of amplifiers and oscillators
CO3	Design simple combinational and sequential logic circuits
CO4	Identify functions of digital multimeter, cathode ray oscilloscope and transducers in the measurement of physical variables
CO5	Understand fundamental principles of radio communication

Text Books:

1. Salivahanan, N Suresh Kumar Electronic Devices and circuits, 3 rd Edition, McGraw Hill publications.
2. A. Ananda Kumar, Switching theory and logic design, Prentice Hall of India Ltd.
3. Helfrick and cooper, Modern Electronic Instrumention and Measurement techniques, Pearson Education.
4. Anokh Singh, Principles of Communication Engineering, S.Chand& Co. New Delhi
5. P. Ramakrishna, Analog Communication, Mcgraw Hill Co.

Mapping of Course Outcomes with Program Outcomes:

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

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S. V. University College of Engineering:: TIRUPATI

CET 41 ENGINEERING MECHANICS

Lecture/ week: 02 hrs

Credits: 04
Sessionals: 20+20
End Semester Exam: 60

Course Objective:

- To learn about forces and force systems and their applications.
- To learn how to find centroid and Moments of Inertia of different objects using mathematical formula.
- To learn about rectilinear and curvilinear motions of bodies and explain the resolution of a system of forces, compute their resultant and solve problems using equations of equilibrium
- To explain kinetics and kinematics of particles, projectiles, curvilinear motion, centroid motion and plane motion of rigid bodies.
- To explain the concepts of work-energy method and its applications to translation, rotation and plane motion and the concept of vibrations.

UNIT – I

Statics : Basic concepts – System of force, Concurrent and non – concurrent Coplanar and non – coplanar forces – Resultant – Moment of force and its applications – Couples and resultant of force systems – Equilibrium of systems of forces – free body diagrams (FBDs), Equations of equilibrium of coplanar systems and spatial systems.

UNIT-II

Center of gravity and moment of inertia – Theory of Pappus – Centroids of composite figures – Areas of gravity of bodies – Moment of inertia – Parallel and perpendicular axis theorems – Moments of inertia of composite of areas (rolled and built – up sections) – Radius of gyration of areas.

UNIT-III

Simple Stress and Strains – Elasticity and Plasticity – Types of stresses and strains – Hooke's law – Stress – Strain diagram for mild steel – Working stress – Factor of safety.

Lateral Strain and Poisson's ratio – Volumetric strain – Elastic module and relationship between elastic constants – Bars of varying section – Composite bars – Temperature stresses. Strain energy - principles of virtual work.

UNIT-IV

Kinematics: Rectilinear and Curvilinear motion – Velocity and Acceleration – Motion of A Rigid Body
– Types and their Analysis in Planar Motion.

Kinetics: Analysis as a particle and Analysis as a Rigid Body in Translation – Central Forces of motion– Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies – Work Energy Method – Equation for Translation – Work Energy application to Particle Motion, Connection System – Fixed axis Rotation and Plane Motion

UNIT-V

Analysis of Perfect Frames: Types of frames – cantilever frames and simply supported frames – Analysis of frames using method of joints and method of sections.
Mechanical Vibrations: Definitions, Concepts-Simple Harmonic motion-Free vibrations-Simple Compound and Torsional pendulum- Numerical problems

Course Outcome:

CO1	Able to determine the resultant force and moment for a given force system
CO2	able to determine the centroid and moment of inertia of composite sections
CO3	Able to analyze stresses and strains of elastic and plastic materials in real life.
CO4	Able to determine strains and temperature stresses in composite bars
CO5	Able to analyze Gradual, sudden and impact loadings

Text Books:

1. **Ghose, D.N.,** Applied Mechanics and Strength of Materials
2. **Timoshenko and Young,** Engineering Mechanics
3. **Junarkar, S.B.** Mechanics of Structures, Vol. 1.
4. **Junarkar, S.B.,** Elements of Applied Mechanics

Mapping of Course Outcomes with Program Outcomes:

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

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ENT01 ENGLISH

Instruction Hours / Week : 3 **Credits: 3**

Common to all branches and with effect from 2016-17

Course Objective:

- Improve the language proficiency of students in English with an emphasis on Vocabulary, Grammar, Reading and Writing skills.
- Equip students to study academic subjects more effectively and critically using the theoretical and practical components of English syllabus.
- Develop study skills and communication skills in formal and informal situations.
- To develop communication skills among the students.
- To construct proficiency in academic and social purpose to improve their grammatical accuracy.

Unit-I Effective Communication: Role and Importance of Communication, Features of Human Communication, Process of Communication, Interpersonal Communication, Barriers, Types- Verbal, Non-Verbal.

Unit-II Grammar: Articles, prepositions, tenses, reported speech, idioms and phrases

Unit-III Listening Skills: Process of Listening, Tips for Effective Listening,

Speaking Skills: Basics of Spoken English, English Sounds, Rhythm and Intonation

Telephonic Skills, Group Communication

Reading Skills: Developing Reading Skills, Reading Strategies, Reading Comprehension,

Writing Skills: Paragraph Writing, Essay Writing, E-writing, Job applications, , Reports. Resume and Letter Writing.

Unit-IV

Soft Skills: Tem Work Skills, Interview Skills, Problem- Solving Skills Adoptability Skills,

Presentation Skills and Group Discussions.

Unit- V Stories from Delight and Wisdom (An Anthology of Short Stories)

Course Outcome:

CO1	Able to understand the use of English in everyday situations and contexts.
CO2	Student will be in a position to face computer based competition exams like TOEFL.
CO3	Able to communicate effectively and write accurately using English language.
CO4	By the end of the course students will be able to graduate with good English competence
CO5	Phonetics makes the students to pronounce accurately

1. The Gift of Magi By O. Henry
2. The Diamond Necklace by Guy De Maupassant
3. My Brother, My Brother by Norah Burke
4. The Open Window by Saki
5. The Child by Premchand

Text Books:

1. Oxford guide to Effective writing and Speaking by John Seely, Oxford University Press, 2013, ISBN- 978-0-19-871393-7
2. Delight and Wisdom published by Orient Blackswan, 2009, ISBN: 978-81-250-3716-3

Reference Books:

1. David Green, Structure and Composition in English, Macmillan Publishers India Limted.
2. Communicative English by E. Suresh Kumar, P. Sreehari, Orient BalckSwan, 2009. ISBN: 13:9788125032502
3. English and Soft Skills by S P Dhanavelpublished byOrient Blackswan, 2013. ISBN 9788125039808
4. Personality Development and Soft Skills by Barun K. Mitrapublished byOxford University Press. 2012. ISBN : 13:97280198066217

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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CSP02 DATA STRUCTURES LAB

Instruction Hours / Week : 3 **Credits: 2**

Common to all branches and with effect from 2016-17

Course Objective:

- The course is designed to develop skills to design and analyze simple linear and non-linear data structures.
- To make the student learn an object oriented way of solving problems.
- It strengthen the ability to the students to identify and apply the suitable data structure for the given real world problem.
- It enables them to gain knowledge in practical applications of data structures.
- It is used to choose the appropriate data structure and algorithm design method for a specified application and determine which algorithm or data structure to use in different scenarios.

1. Write a C++ Program to create a sequential file with at least 5 records, each record having thestructure shown below:

USN	**Name**	**Marks1**	**Marks2**	**Marks3**
Non-zero positive integer	25 Characters	Positive Integer	Positive Integer	Positive Integer

Write necessary functions

a. To display all the records in the file.

b. To search for a specific record based on the USN. In case the record is not found, suitable message should be displayed. Both the options in this case must be demonstrated.

2. Write and demonstrate the following C++ functions:
   a. newStrCpythat does the same job as **strcpy**

b. **newStrCat** that does the same job as **strcat** without using any library functions.

3. Write a C++ Program, which accepts the Internet Protocol (IP) address in decimal dot format(ex. 153.18.8.105) and converts it into 32-bit long integer (ex. 2568095849) using **strtok** library function and unions.
4. Write a C++ Program to construct a **stack of integers** and to perform the following operations on it:

    a. Push

    b. Pop

    c. Display

The program should print appropriate messages for stack overflow, stack underflow, and stack empty.

1. Write a C++ Program to convert and print a given valid parenthesized **infix** arithmetic expression to **postfix** expression. The expression consists of single character operands and the binary operators+ (plus), - (minus), * (multiply) and / (divide).
2. Write a C++ Program to evaluate a valid **suffix/postfix** expression using stack. Assume that thesuffix/postfix expression is read as a single line consisting of non-negative single digit operands and binary arithmetic operators. The arithmetic operators are + (add), - (subtract), * (multiply) and / (divide).
3. Write a C++ Program to simulate the working of a **queue of integers** using an array. Provide the following operations:

    d. Insert

    e. Delete

    f. Display

4. Write a C++ Program to simulate the working of a **circular queue of integers** using an array. Providethe following operations:

    g. Insert

    h. Delete

    i. Display

5. Write a C++ Program using dynamic variables and pointers, to construct a **singly linked list** consisting of the following information in each node: student id (integer), student name (character string) and semester (integer). The operations to be supported are:

j. The insertion operation
   i. At the front of a list
   ii. At the back of the list
   iii. At any position in the list
k. Deleting a node based on student id. If the specified node is not present in the list an error Message should be displayed. Both the options should be demonstrated.
l. Searching a node based on student id and updates the information content. If the specified Node is not present in the list an error message should be displayed. Both situations shouldbe displayed.
m. Displaying all the nodes in the list.
(Note: Only one set of operations among a, b and c with d may be asked in the examination)

6. Write a C++ Program using dynamic variables and pointers to construct a **stack of integers** using**singly linked list** and to perform the following operations:
   n. Push
   o. Pop
   p. Display

   The program should print appropriate messages for stack overflow and stack empty.

7. Write a C++ Program using dynamic variables and pointers to construct a **queue of integers** using **singly linked list** and to perform the following operations:
   q. Insert
   r. Delete
   s. Display

   The program should print appropriate messages for queue full and queue empty.

8. Write a C++ Program to support the following operations on a **doubly linked list** where each node consists of integers:
   t. Create a doubly linked list by adding each node at the front.
   u. Insert a new node to the left of the node whose key value is read as an input
   v. Delete the node of a given data, if it is found, otherwise display appropriate message.
   w. Display the contents of the list.
   (Note: Only either (a, b and d) or (a, c and d) may be asked in the examination)

9. Write a C++ Program
   x. To construct a **binary search tree** of integers.
   y. To traverse the tree using all the methods i.e., **inorder, preorder and postorder**.
   z. To display the elements in the tree.
10. Write recursive C++ Programs for

Searching an element on a given list of integers using the

aa. Binary Search method.

bb. Solving the **Towers of Hanoi problem**.

5. Course Outcome:

6.

CO1	Acquire knowledge of various Methods and Notations for comparing the performance of various Data Structures.
CO2	Acquire knowledge of development of linear data structures like stacks, Queues and their operations, Implementation using Arrays and Linked Lists.
CO3	Acquire knowledge of properties of Binary Search Trees, balanced binary search trees, Splay Trees, Red Black Trees, AVL Trees and their implementation
CO4	Acquire knowledge of efficient external searching techniques using Indexing, Hashing.
CO5	Acquire knowledge of indexing implementation in B-Trees and B+ Trees

Text Books:

1. Data structures and Algorithms using C++, AnandaRaoAkepogu and RadhikaRajuPalagiri, Pearson Education.
2. C++ Solutions for Mathematical Problems, Ghosh, Arun, New Age International Publishers.
3. Data Structures A Pseudocode Approach with C++, IndiaEdition, R.F.GilbergandB.A.Forouzan,Cengage Learning.
4. Programming Principles and Practice using C++,B.Stroustrup,Addison-Wesley(Pearson education).
5. Data Structures and STL, W.J.Collins,McGrawHill,International edition.
6. Data structures and Algorithms with OODesign patterns inC++,B.R.Priess,John Wiley& sons.
7. The Art,Philosophy, and Science of OOP with C++,RickMiller,SPD.
8. C++ for Programmers,P.J.Deitel and H.M.Deitel,PHI/Pearson

Mapping of Course Outcomes with Program Outcomes:

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

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ENP01 ENGLISH COMMUNICATION LAB

Instruction Hours / Week : 3 **Credits: 2**

Common to all branches and with effect from 2016-17

Course Objective:

- To improve the students' fluency in English, through a well-developed vocabulary
- To enable them listening spoken English at normal conversational speed by educated English speakers
- To respond appropriately in different socio-cultural and professional contexts.
- To communicate effectively and appropriately in real life situation and develop drafting skills among the students.
- To develop and integrate use of the four language skills and enhance employability skills

Syllabus

At least twenty exercises covering the topics: Stress, Introduction, Accent, Intonation, English vsHinglishand Important Skills using Computer-Aided Packages.

Course Outcome:

CO1	Better pronunciation and accent
CO2	Ability to use functional English
CO3	Competency in analytical skills and problem solving skills
CO4	Increase possibilities of job prospects
CO5	Communicate confidently in formal and informal contexts

Text Book:

1. Barry Tomalin and Suhashini Thomas, International English for Call Centres, McMillan Publishers, India Limited, 2009

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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MAT 03 ENGINEERING MATHEMATICS – III

Lecture/ week: 03 hrs

Credits: 03
Sessionals: 20+20
End Semester Exam: 60

COURSE OBJECTIVES:

- To develop logical understanding of the subject.
- To develop mathematical skill so that students are able to apply mathematical methods & principals in solving problem from Engineering fields.
- To make aware students about the importance and symbiosis between Mathematics and Engineering.

Unit – I

Simple correlation and regression – Curve fitting – Fitting Linear, second degree and exponential curve by the method of least squares – Normal distribution

Unit – II

Determination of roots of non – linear equations: Bisection method – Falsi position method – Newton Raphson method – Iterative method. Solutions of system of linear equations: Gauss elimination with pivotal condensation – Gauss Jacobian, Gauss Seidel iteration methods.

Unit – III

Numerical interpolation: Newtons's forward and backward interpolation formulae – Lagrange's interpolation formulae, Finding first and second order differential coefficients using Newton's formulae. Numerical integration – Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules.

Unit – IV

Solutions of ordinary differential equations: Taylor's series – Euler method – Modified Euler's method – Runge Kutta methods (second and fourth order only) – Minlne's predictor corrector method.

Unit – V

Solutions of partial differential equations: Solutions of Laplace equation by Liebmann's iteration process – solution of Poisson's equations by using Gauss Seidel iteration method.

COURSE OUTCOMES:

CO1	Applying various statistical models and methods for drawing conclusions and making decisions under uncertainty in engineering contexts
CO2	Apply statistical and numerical methods in various computer science related projects, seminars and research
CO3	Apply the knowledge of iterative methods to solve algebraic and transcendental equations, simultaneous linear equations, ODE (ordinary differential equations)
CO4	Acquire knowledge of finite differences, interpolation, numerical differentiation and numerical integration
CO5	Demonstrate a basic knowledge of the techniques for accurate and efficient solution of models based on linear and nonlinear systems of equations, ordinary differential equations and partial differential equations

Text Books:

1. **M. Ray & H.S. Sharma**, *Mathematical Statistics*, Ram Prasad &Sons.
2. **S. Armugam**, *Numerical Methods*, Second Edition, Scitech Publications, Chennai.

References:

1. **B.S. Grewel**, *Higher Engineering Mathematics*, Thirty First Edition, Khanna Publications, 1995.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

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CET 42 MECHANICS OF SOLIDS

Lectures/Week : 4 periods

Credits: 04
Sessionals: 20 +20
End Examination Marks: 60

COURSE OBJECTIVES:

- To establish an understanding of the fundamental concepts of mechanics of deformable solids; including static equilibrium, geometry of deformation, and material constitutive behavior.
- Mechanical behavior of the body by determining the stresses, strains and deflections produced by the loads up to the elastic limit.
- Fundamental concepts related to deformation, strain energy, moment of inertia, load carrying capacity, slope an deflection of beams, shear forces, bending moments, torsional moments, column and struts, principal stresses and strains and theories of failure.
- To provide students with exposure to the systematic methods for solving engineering problems in solid mechanics

UNIT –I

Complex Stresses: Stresses on an inclined plane under different uni axial and biaxial stress conditions, Principal planes and principal stresses, Mohr's circle, Lateral Contraction.

Stresses due to rotation: Wheel rim, disc of uniform thickness, disc of uniform strength.

UNIT – II

Bending Moments and Shear Forces: Beam – Types of loads, Types of supports, S.F. and B.M. diagrams for cantilever, simply supported and over hanging beams.

Unsymmetrical bending and shear center: Principle axes of sections, circle of inertia, shear center to rectangular sections, I-sections and L-sections.

UNIT –III

Bending Stress in beams: Theory of simple bending – Assumptions – Derivation of bending equation. Position of N.A. – Moment of Resistance of rectangular section, I-Section and triangular section.

Shear stress: Equation for shear stress distribution across any cross section of beam – shear stress distribution across rectangular, circular, triangular, I-Sections.

UNIT –IV

Deflections of Beams: Relation between curvature, slope and defection, double integration method, Macaulay's method, Moment area method.

Torsional Stresses in shafts and springs: Analysis of torsional stresses, Power transmitted, combined bending and torsion, Closed and open coiled helical springs. Laminated springs.

UNIT –V

Cylinders and Spherical Shells: Stresses and strains in thin cylinders, Thin Spherical shell. Thick cylinders subjected to internal and external pressure. Compound Thick cylinders, Shrink fit.

COURSE OUTCOMES:

CO1	Able to select materials, types and allowances of patterns and analyze the components of moulds, gating system in metal casting processes.
CO2	Develop process-maps for metal working processes using plasticity principles
CO3	Able to analyze Hot and Cold Working, Forging, Extrusion and Drawing Processes
CO4	Design and Analyze different sheet metal working processes
CO5	Understand different Welding and joining processes and its defects

Text Books:

Vaizirani and Ratwani *Analysis of Structure*, Vol. 1, 17th Edition, Khanna Publishers, 1997.

R.K.Bansal, Sterngth of Materials, Laxmi Publishers.5th Edition,2012

REFERENCE:

Timoshenko *Strength of Materials* 3rd Edition, Krieger Publications, 1983.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

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FEC 01 PROFESSIONAL ETHICS

Lectures/Week : 2 periods

Credits: 02
Sessionals: 20 +20
End Examination Marks: 60

COURSE OBJECTIVES:

- To inculcate the sense of social responsibility.
- To develop a firm ethical base.
- To make the students realize the significance of ethics in professional environment

UNIT –I

Introduction: Background ideas – why study engineering ethics? Engineering is managing the unknown – Personal vs. Business ethics – The Origins of Ethical thought – Ethics and the Law – Ethics Problems are like design problems.

Unit – II

Professionalism and codes of ethics – Introduction – Is engineering a Profession? Codes of Ethics – Understanding ethical problems. A brief history of ethical thought – Ethical theories.

Unit – III

Ethical problem solving techniques – Analysis of issues in ethical problems – Line drawing – Flow charting – Conflict Problems – An application of Problem solving methods – Bribery/Acceptance of gifts.

Unit IV

Safety and Risk – Engineers and Safety – Designing for safety – The rights and responsibilities of engineers – Professional responsibilities – Computer ethics – Professional rights – Whistleblowing – Types of whistleblowing.

Unit – V

Ethics in research and experimentation – Ethics and Research – Pathological science – Doing the right thing.

COURSE OUTCOMES:

CO1	Able to distinguish among morals, values, ethics, and the law and to explore how they each impacts professional practice.
CO2	Understand various social issues, industrial standards, code of ethics and role of professional ethics in engineering field.
CO3	Apply creative thinking to solve ethical problems in business setting and develop analytical thinking skills necessary to successfully manage ethical decisions and dilemmas.
CO4	Aware of responsibilities of an engineer for safety and risk benefit analysis, professional rights and responsibilities of an engineer.
CO5	Able to know doing the things right in various issues of research and experimentation in ethical manner.

Text Book:

1. **Charles B. Fleddermann**, *Engineering Ethics*, Pearson Education, 2004.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

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MET 02 THERMODYNAMICS

Credits : 4

Lectures/week: 4 Hrs. Sessional Marks: 20+20

End Examination Marks:60

COURSE OBJECTIVES:

- To understand the concept of quantity and quality of energy.
- To understand use of steam for power generation and process heating.
- To prepare the student to effectively use thermodynamics, in the practice of engineering.
- To lay the ground work for subsequent studies in such fields as fluid mechanics, heat transfer etc.
- To learn from experimentation calorific value of fuels and analyze the chemical analysis

UNIT – I

Basic Concepts Scope of Thermodynamics – Macroscopic and Microscopic properties Thermodynamic system – Control Volume – Thermodynamic Properties – Processes and cycles – Thermodynamic Equilibrium – Quasi static process – Zeroth Law Of Thermodynamics – Measurement of temperature – Thermocouple – Work transfer – pdv work – Network done by a system – Specific heats and latent heat.

First Law of Thermodynamics: Energy – Different forms of stored energy – closed systems and steady flow systems – First law applied to flow process – Mass balance and energy balance in steady flow process – Perpetual motion machine of first kind.

UNIT – II

Boyle's Law – Charles Law – Characteristic equation of gas – Avagadro's Law – Joule's Law – First Law and non-flow Processes Constant volume – Constant Pressure – Isothermal – Hyperbolic – Adiabatic – free expansion and polytropic processes – Real gases Dalton's Law of pressures – Avogadro's Law – Gibb's – Dalton's Law of mixture of gases.

Second Law of Thermodynamics: Limitations of first law – Heat engines and Heat reservoirs – Kelvin Planks statement of second law – Clausius inequality – refrigeration and heat pump reversibility and irreversibility – Carnot cycle – Reversible heat engine – Carnot Theorem – Corollaries – Efficiency of reversed heat engine.

UNIT – III

Entropy and availability: Claussiu's theorem – The property of entropy – temperature entropy plot – Principle of increase of entropy – Entropy changes in various thermodynamic processes.

Availability: Availability energy referred to a cycle – The Helmholtz function and Gibb's functions – Availability in steady flow combined first law and second laws – Tds equations – energy equation – Joules Kelvin effect – Claussius – Clapeyrm equation – Gibbs phase rule.

UNIT – IV

Gas Power cycles: Carnot cycle – Stirling cycle – Eriksson cycle – Air standard cycles – Otto cycle – Diesel cycle – limited pressure cycle Mixed cycle or duel cycle – Comparison of cycles – Brayton cycle.

UNIT – V

Fuels and Combustion: Conventional fuels – Calorific value of fuels (solid – liquid and gaseous) Experimental determination and calculation from chemical analysis – Combustion equations – Air required for complete combustion – Excess air – Determination of air fuel ratio and weight of flue gases.

COURSE OUTCOMES:

CO1	Understand the concepts of continuum, system, control volume, thermodynamic properties, thermodynamic equilibrium, work and heat.
CO2	Apply various laws of thermodynamics to various processes and real systems.
CO3	Apply the concept of Entropy, Calculate heat, work and other important thermodynamic properties for various ideal gas processes.
CO4	Estimate performance of various Thermodynamic gas power cycles and gas refrigeration cycle and availability in each case
CO5	Able to find out calorific value of fuels and analyze the chemical analysis from experimentation

TEXT BOOKS:

1. Engineering Thermodynamics : Nag. P.K.
2. Heat Engineering : Vasandani V.P. and Kumar D.S.
3. Heat Engines : Ballaney P.L.
4. Engineering Thermodynamics - Fundamentals and Applications : Natarajan. E, Anuragam Publications.
5. Engineering Thermodynamics : Chattopadhyay. P
6. Thermodynamics : C.P. Arora
7. Basic Engineering Thermodynamics : A. Venkatesh
8. Engineering Thermodynamics : Gordon Rogers and Yon Mayhew
9. Engineering Thermodynamics : Jones and Dugan

REFERENCES:

1. Applied Thermodynamics : Eastop and Mckankey.
2. Thermodynamics : J.P. Holman – McGraw-Hill

3. Fundamentals of Engineering Thermodynamics : E. Rathkrishnan
4. Thermodynamics for Engineers : Kau – Fui Vincent Wong.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

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MET 03 ADVANCED ENGINEERING GRAPHICS

Lecture/Hours per week: 02 hrs | Credits: 04
Drawing/week: 03 hrs | Sessionals: 20+20
End Semester Exam: 60

COURSE OBJECTIVES:

- To know about different types of projection
- To know projection of solids and section of solids.
- To know development of different types of surfaces.
- To know about isometric projection.

UNIT-I

Sections of solids of tetrahedron, cube, prism, pyramids and cone, section planes perpendicular to HP and inclined to VP, Section planes perpendicular to VP and inclined to HP sections plane Perpendicular to both HP and VP.

UNIT-II

Development of surfaces: Development of lateral surfaces of right regular solids as prisms, pyramids, cylinders and cones which are cut by plane inclined to HP only.

UNIT-III

Introduction to interpenetration of solids of intersection of two prisms, cylinders, cone and cylinder.

UNIT-IV

Isometric Projections: Isometric Projections and views such as prisms, Pyramids, cylinders and cones. Solids placed one over the other.

UNIT-V

Introduction to AUTOCAD-Co-ordinate system, Object snap, Draw Tools -Line, Polyline, Rectangle, circle, spline, Ellipse, Point, Hatch, Text, Modify Tools - Erase, copy, Mirror, Offset, Array, Move Rotate, Trim, Fillet, Dimensions - Dimension Variables, Linear, Aligned, Radius and diameter, Angular Dimensions

COURSE OUTCOMES:

CO1	Able to draw Projections of solids and Auxiliary projections of solids parallel to one plane perpendicular to both the planes
CO2	Able to analyze and draw section of solids inclined to both the planes
CO3	Able to develop surfaces of solids which are perpendicular to both the planes
CO4	Able to draw interpretation of solids in any angle
CO5	Able to draw isometric projections of simple objects

Text Books:

1. **Bhatt N.D. and V.M. Panchal,** Engineering Drawing Revised Edition, Charotar Publications, 2010.
2. **Dhananjaya A Jolhe,** Engineering Drawing with an introduction to Auto CAD, Tata MeGrawhill - 2009.
3. **Gautam Pohit, Gautam Gosh:** Machine Drawing with auto cad-Pearson Publications
4. **K.L.Narayana and P. Kannaih,** A text Book of Engineering Drawing, SCITECH Publications – (1999)
5. **K. Venugopal:** Engineering Drawing & Graphics, New age International Publishers.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

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MET 04 MANUFACTURING PROCESSES

Lectures/Week : 4 periods | Credits: 04
Sessionals: 20 +20
End Examination Marks: 60

COURSE OBJECTIVES:

- To understand the primary manufacturing process classification and use in mechanical engineering.
- To acquire the knowledge of casting, metal forming and metal joining processes from the point of view of tools and equipments required, materials processed, process parameters .
- To get the practical exposure of utilization of manufacturing techniques for product making through practical and industry visit.

UNIT – I

Introduction: Definition and Classification of Manufacturing Processes, Various kinds of Productions, Selection of Materials, Types of Materials, Properties of Materials, Selection of Manufacturing Processes, Modern concepts of Manufacturing.

UNIT – II

Foundry Processes: Introduction to foundry shop, molding-molding materials, sand mold casting, Patterns, Cores, Gates and Risers, Different types of casting processes, Foundry furnaces and melting furnaces, Casting Defects.

UNIT – III

Metal Forming processes: Nature of plastic deformation, hot working and cold working.

Rolling- Principle, Rolling stand arrangement, Roll passes, Breakdown passes, Roll pass sequences.

Forging: Introduction, various forging operations, Forgeability of metals, Forging Defects, Die Design, Die Manufacturing Methods, Forging machines.

UNIT – IV

Extrusion and Drawing: Introduction, Different types of Extrusion processes, equipments, defects in extrusion. Drawing processes, Drawing practice and Drawing Defects, Drawing equipments.

Sheet Metal Forming Processes: Press tool operations, shearing action, Sheet metal characteristics and Formability, Bending, Deep Drawing, Spinning, Stretch Forming, Embossing

and Coining.

UNIT – V

Fabrication Processes: Classification, General consideration, Joining processes, Fusion welding processes, Solid state welding processes, LBW, EBW, Soldering and Brazing.

COURSE OUTCOMES:

CO1	Able to select materials, types and allowances of patterns and analyze the components of moulds, gating system in metal casting processes.
CO2	Develop process-maps for metal working processes using plasticity principles
CO3	Able to analyze Hot and Cold Working, Forging, Extrusion and Drawing Processes
CO4	Design and Analyze different sheet metal working processes
CO5	Understand different Welding and joining processes and its defects

Text Books:

1. Serope Kalpakjian: Manufacturing Engineering and Technology, 5th Edition, Pearson Prentice Hall
2. P.N. Rao: Manufacturing Technology, 2nd Edition, Tata McGraw – Hill, 2007
3. P.C. Sharma: A Textbook of Production Technology: Manufacturing Process, 7th Edition, S. Chand & Company Limited, 2007

References:

1. J.P. Kaushish: Manufacturing Processes, 2nd Edition
2. R.S. Khurmi and J.K. Gupta: A Textbook of Workshop Technology: Manufacturing Processes, 7th Edition, S. Chand & Company Limited, 2008
3. Hahra Choudhury SK: Elements of Workshop Technology, Volume-1, Indian Book Distribution Co. Calcutta

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

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CEP 41 MECHANCIS OF SOLIDS LAB

Practicals/Week : 3 periods

Credits: 02
Sessionals: 20 +20
End Examination Marks: 60

COURSE OBJECTIVES:

- Ability to conduct standard tension tests of steel and other metals
- Ability to conduct compression tests of concrete, cast iron and steel
- Ability to conduct tests with materials subjected to torsion
- Ability to conduct simple tests of column buckling
- Ability to use strain gages for strain measurement

LIST OF EXPERIMENTS:

1. Tension test on mild steel bar
2. Tension test on HYSD steel bar
3. Compression test on wood
4. Shear test on wood
5. Torsion test on steel
6. Test on close coiled helical spring
7. Bending test on rolled steel joist
8. Bending test carriage spring
9. Charpy impact test
10. Deflection test on a beam under Uniform Bending
11. Deflection test on simple supported beam
12. Deflection test on fixed beam

COURSE OUTCOMES:

CO1	Analyze the behavior of the solid bodies subjected to various types of loading.
CO2	Apply knowledge of materials and structural elements to the analysis of simple structures.
CO3	Undertake problem identification, formulation and solution using a range of analytical methods.
CO4	Analyze and interpret laboratory data relating to behavior of structures and the materials they are made of, and undertake associated laboratory work individually and in teams.
CO5	Expectation and capacity to undertake lifelong learning.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

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MEP 02 MANUFACTURING PROCESSES LAB

Practicals/Week : 3 periods

Credits: 02
Sessionals: 20 +20
End Examination Marks: 60

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

COURSE OBJECTIVES:

- Understand practical orientation of manufacturing processes.
- Knowledge on different kinds of production processes and practices available for shaping or molding several daily used parts for industries.
- Prepare assembly drawings, sectional views and bill of materials for selection of equipments for various manufacturing processes will be understood.

LIST OF EXPERIMENTS:

LATHE

Model 1: Step Turning

Model 2: Taper Turning with Knurling

Model 3: V Threading

SHAPER

Model 4: Making Square prism on Shaper

Model 5: Slot Cutting with Shaping Machine

MILLING MACHINE

Model 6: Rectangular Slot Cutting on Vertical Milling Machine

Model 7: Hexagonal Cutting on Horizontal Milling Machine

Model 8: Spur Gear cutting on Milling

THREADING

Model 9: Square Threading

Model 10: Double Start V Threading

Model 11: Drilling and Tapping

Model 12: Joining of Two Metal Work Pieces with Arc Welding or Gas Welding

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Model 13: Pattern Making Related Moulding

COURSE OUTCOMES:

CO1	To impart knowledge of different types of machine tools and their constructional details like lathe, milling and shaping machines.
CO2	Able to develop knowledge about types of cutting tools, single point and multi point cutting tool and the manufacture of these tools, the speeds at which a specific type of tool will machine a particular type of material.
CO3	Acquire knowledge about coolants and lubrication, their use and purpose while machining.
CO4	Able to analyze different types of cutting tools, single point and multi point cutting tool and the manufacture of these tools, the speeds at which a specific type of tool will machine a particular type of material.
CO5	Able to perform different operations on lathe, milling and shaping by conducting experiments on these machine tools.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

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EOT 01 MANAGERIAL ECONOMICS

Lectures/Week : 2 periods

Credits: 02
Sessionals: 20 +20
End Examination Marks: 60

COURSE OBJECTIVES:

- Apply the knowledge of the mechanics of supply and demand to explain working of markets
- Describe how changes in demand and supply affect markets
- Understand the choices made by a rational consumer
- Explain relationships between production and costs
- Define key characteristics and consequences of different forms of markets

UNIT – I

Introduction – Nature and Scope of Managerial Economics, Economic Theory and Managerial Economics.

UNIT – II

Demand Analysis and Forecasting – Demand Determinants, Demand Distinctions, Demand Forecasting: Methods of Demand Forecasting. Minimum average method and exponential method.

UNIT – III

Cost Analysis – Cost Concepts, Classifications and Determinants; Cost-output Relationship, Economies and Diseconomies of scale, Cost Control and Cost Reduction.

UNIT – IV

Price and output Decisions Under Different Markets Structures – Perfect Competition, Monopoly and Monopsony; price Discrimination, Monopolistic Competition, Oligopoly and Oligopsony.

UNIT – V

Pricing Policies and Practices – Pricing Policies, Pricing Methods, Specific Pricing Policies, Price Discounts and Differentials; Product-line Coverage and Pricing; Price Forecasting.

COURSE OUTCOMES:

CO1	Analyze the demand and supply conditions and assess the position of a company
CO2	Design competition strategies, including costing, pricing, product differentiation, and market environment according to the natures of products and the structures of the markets.
CO3	Assess the relationships between short-run and long-run costs.
CO4	Appraise some of the current and emerging issues in managerial economics at the national and international levels.
CO5	Explain four different pricing practices such as discrimination, two part pricing, block pricing, commodity bundling, transfer pricing, and peak load pricing

Text Books

1. **Varshney R L and Maheswari K L :** Managerial Economics, 19th Edition, Sultan Chand and Sons, 2009.

Reference Book

2. **Froeb L M and McCann B T:** Managerial Economics A Problem Solving Approach, Second Edition, Cengage Learning, 2008.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

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MET 05 KINEMATICS OF MACHINERY

Lectures/Week : 4 periods

Credits: 04
Sessionals: 20 +20
End Examination Marks: 60

COURSE OBJECTIVES:

- To develop skills for designing and analyzing linkages, cams, gears and other mechanisms.
- To provide a foundation for the study of machine design.
- Development of individual and team skills involving pre- and post-processing and interpretation computer-aided design and analysis data.
- Development of individual and team communications skills.

UNIT – I

MECHANISMS : Elements or Links – Classification – Rigid Link, flexible and fluid link – Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained.

MACHINES : Mechanism and machines – classification of machines – kinematic chain – inversion of mechanism– inversions of quadric cycle chain – single and double slider crank chains.

UNIT – II

STRAIGHT LINE MOTION MECHANISMS: Exact and approximate, copied and generated types –Peaucellier - Hart - Scott Russel – Grasshopper – Watt- Tchebicheff - Robert Mechanisms and Pantograph.

STEERING MECHANISMS: Conditions for correct steering – Davis Steering gear, Ackermans steering gear – velocity ratio.

UNIT – III

KINEMATICS OF MECHANISMS AND LINKAGES: Determination of velocities in mechanisms. Relative velocity method, Relative velocities of particles in common links. Velocity diagrams of various mechanisms. Instantaneous centers of rotation – Kennedy's theorem and its applications to planar mechanism.

Resultant acceleration of particles in common links and mechanisms. Resultant acceleration of particles on links having angular and linear motion. Coriolis component of acceleration.

UNIT – IV

GEARS: Higher pairs, friction wheels and toothed gears – types – law of gearing, condition for constant velocity ratio for transmission of motion, Forms of tooth- cycloidal and involute profiles. Velocity of sliding – phenomena of interference – Methods to avoid interference. Condition for minimum number of teeth to avoid interference, expressions for arc of contact and

path of contact.

GEAR TRAINS: Introduction –Types of gears – Simple, compound, reverted and Epicyclic gear trains. Train value – Methods of finding train value or velocity ratio – Tabular column method for Epicyclic gear trains. Torque in epicyclic gear trains. Differential gear of an automobile.

UNIT – V

CAMS: Types of cams and followers – displacement, velocity and acceleration curves – Cams with radial follower – oscillatory follower – Cam profiles for specified motions – disk cam with radial flat faced follower – roller follower – Oscillatory follower cams of specified contours – Analysis of straight sided and convex sides cam.

COURSE OUTCOMES:

CO1	Understand the principles of kinematic pairs, chains and their classification, DOF, inversions, equivalent chains and planar mechanisms.
CO2	Acquire knowledge and develop straight line motion mechanisms and steering mechanisms.
CO3	Able to draw velocity and acceleration diagrams for different mechanisms
CO4	Able to design and develop gear and gear train depending on application.
CO5	Design cams and followers for specified motion profiles.

Text Books:

1. Theory of Machines :S.S.Rathan / TMH
2. Theory of Machines :R.S. Khurmi. / S. Chand
3. Mechanisms and Machine theory :J.S. Rao and R.V. Dukkipati. / New Age
4. Theory of Machines & Mechanisms :PL. Ballaney / Khanna Publishers

References :

1. The theory of Machines :Shigley J.E / Oxford University Press
2. Mechanisms and Dynamics of Machinery : Hamilton Mabie H. and F.W.Ocvirk / Oxford University Pres

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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			**3**	**1**								
CO4			**1**									
CO5			1		**3**	**2**						

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MET 06 THERMAL ENGINEERING

Credits : 4
Lectures/week: 4 Hrs. Sessional Marks: 20+20
End Examination Marks:60

COURSE OBJECTIVES:

- To apply the laws of Thermodynamics
- To analyze air standard cycles and
- To understand and evaluate the perform analysis of the major components and systems of IC engines, refrigeration cycles and their applications.

UNIT – I

Steam properties and stream generators: Properties of steam – use of steam tables – PV, TS, HS diagrams – steam processes – constant volume – constant pressure – Isothermal – Adiabatic and Hyperbolic processes – Throttling expansion.

Steam Generators: Classification of fire tube and water tube boilers – introduction to high pressure boilers – boiler mountings and accessories – boiler performance – boiler draught.

UNIT – II

Vapour Power Cycles: Basic steam power cycles – Carnot cycle and ranking cycle – Modified ranking cycle, Binary Vapour Cycle.

UNIT – III

Steam Engines: Principles of operation of steam engine condensing – non-condensing – single &double acting – valve events – hypothetical and actual indicator diagrams – diagram factor determination of cylinder dimensions – performance of steam engine – governing of steam engines.

UNIT – IV

Steam Nozzles: Type, isentropic flow of steam through nozzles, velocity & enthalpy drop, variation of velocity – area – specific volume – critical pressure ratio for maximum discharge effect of friction, super saturated flow.

Steam Condensers: Functions of a condenser – classification – jet condenser – parallel flow and counter flow – surface condenser – vacuum efficiency – loss of vacuum & air leakage – air removal.

UNIT – V

Steam Turbines: Principles of operation-classification-impulse and reaction turbines-velocity diagrams-work done-diagram efficiency-effect of blade friction-stage efficiency turbine reheat factor-height of

turbine blade-axial thrust-losses in steam turbine-governing of turbines-reheat and regenerative cycles.

COURSE OUTCOMES:

CO1	Explore their knowledge & ability to design the constructional features of various types of boilers in various fields of energy transfer equipments.
CO2	Knowledge of impact of engineering solutions on the society and also on contemporary issues related to different types of steam cycles and propulsion systems.
CO3	Able to demonstrate and understanding of the main factors, performance and governing of steam engines.
CO4	Design nozzles and condensers with desired needs within realistic constraints such as economic, environmental, social, political, ethical, and safety manufacturability and sustainability related thermal fields like different types of power plants etc.
CO5	Design turbines with desired needs within realistic constraints such as economic, environmental, social, political, ethical, and safety manufacturability and sustainability related thermal fields like different types of power plants etc.

TEXT BOOKS:

1. Heat Engineering : Vasandani V.P and Kumar D.S.
2. Heat Engines : Ballaney P.L.
3. A course in Thermal Engineering : Domukundwar&Kothandaraman
4. Thermal Engineering : R.K. Rajput
5. Thermal Engineering : R. Rudramoorthy
6. Thermal Engineering : K.K. Ramalingam

REFERENCE:

1. Applied Thermodynamics : Eastop and Mckankey.
2. Thermal Engineering : B.K. Sarkar

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

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MET 07 MACHINE TOOLS AND METAL CUTTING

Lectures/Week : 4 periods

Credits: 04
Sessionals: 20 +20
End Examination Marks: 60

COURSE OBJECTIVES:

- The course provides students with fundamental knowledge and principles in material removal processes.
- To demonstrate the fundamentals of machining processes and machine tools.
- To develop knowledge and importance of metal cutting parameters.
- To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.
- To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes.

UNIT – I

Cutting tools : Classification- Nomenclature of Single Point Cutting Tool-Difference 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-Tool life-Tool life equation**.**

UNIT – II

Lathes: Types-operations done on Lathe. Work holding devices. Boring machines-types and constructional details-jig boring machine, shaper, planer and slotting machines-constructional details-Quick return mechanisms-Estimation of machining time in lathe, shaper and planer.

UNIT – III

Drilling Machines: Types-constructional details-operations performed on them. Twist drill-elements. Milling machines- classification- constructional details of various types. Operations performed on milling machines. Milling methods- up cut and down cut milling. Estimation of machining time in milling. Indexing head and types of indexing methods- simple, compound, differential and angle indexing.

UNIT - IV

Milling and Finishing operations: Gear cutting by Milling**:** Spur and Helical Gears. Gear generating methods-gear shaping and gear hobbing.Finishing of gear by gear shaving, gear grinding and gear lapping. Broaching-types of broaches- broaching operations-types of broaching machines-vertical, horizontal, continuous and rotary broaching machines. Grinding- Grinding wheels-manufacturing, specification-wheel selection. Wheel dressing and truing. Different types of grinding machines. Use of magnetic chucks, precision grinding processes lapping, honing and super finishing.

UNIT – V

Non- Conventional Machining: Brief introduction to capstan and Turr et lathes. Non-conventional machining processes- CM, ECM, ECG, EDM, LBM, EBM, USM, WJM, AJM – process capabilities of each process.

COURSE OUTCOMES:

CO1	Understand the cutting tool geometry, mechanism of chip formation and mechanics of orthogonal cutting.
CO2	Identify basic parts and operations of machine tools including lathe, shaper, planer and slotter machines
CO3	Able to know the various operations performed on drilling, drill press and milling machines and also know the nomenclature of cutters.
CO4	Able to select appropriate machining processes and conditions on behalf of different metals for a specific application in real time.
CO5	Able to understand the need and applications of modern machining processes in real life.

TEXT BOOKS:

1. Serope Kalpakjian: Manufacturing Engineering and Technology, 5th Edition, Pearson Prentice Hall.
2. **Hazra choudary and Bose S.K**: Work shop technology vol.II, Tenth Edition, Media, Promoters & Publlishers Pvt. Ltd, 2000.
3. **Raghuvamshi**: Work shop technology vol.II,
4. **Sharma P.C**: Production Engineering, Tenth Edition, S. Chand & Co., 2008
5. **Haslehurst M.:** Manufacturing Technology, Third Edition, Viva Books Pvt. Ltd., 1998
6. **Gupta S.C. and Jain.R.K:** Production Technology, Ninth Edition, Khanna Publishers, 2002

REFERENCES:

HMT: Production Technology, McGraw-Hill Education (India) Pvt Ltd, 28th reprint, 2008

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

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CET 43 Fluid Mechanics and Hydraulic Machinery

Lectures/Week : 4 periods

Credits: 04
Sessionals: 20 +20
End Examination Marks: 60

COURSE OBJECTIVES:

- To understand the basic principles of fluid mechanics
- To identify various types of flows
- To understand boundary layer concepts and flow through pipes
- To evaluate the performance of hydraulic turbines
- To understand the functioning and characteristic curves of pumps

UNIT – I

FLUID PROPERTIES: Definition of a fluid – Density, Specific weight, Specific volume, Specific gravity – Viscosity – Bulk modulus of elasticity – Surface tension and capillarity - Vapour pressure.

FLUID STATICS: Pressure at a point – Pascal's law – Absolute and gauge pressure –Pressure measurement – Piezometer and Manometers.

FLUID DYNAMICS: Types of fluid flow –Continuity equation – Euler's equation - Bernoulli's equation - Moment of momentum equation.

UNIT – II

LAMINAR AND TURBULENT FLOWS: Relation Between Shear and Pressure Gradients– Laminar flow through Circular Pipes – Hagen – Poiseuille Law - Loss of Head due to Friction in Pipes - Darcy – Weisbach Equation - Minor Losses in Pipes.

BOUNDARY LAYER CONCEPT, DRAG AND LIFT: Thickness of Boundary Layer – Boundary Layer Along a Long Thin flat Plate - Turbulent Boundary Layer – Drag and Lift - Types of Drag –Drag on a Sphere – Drag on a Cylinder — Development of Lift on Airfoils.

UNIT – III

IMPACT OF JETS: Impact of Water Jets on Stationary and Moving Flat, Inclined Plates and Curved Vanes – Jet Striking Centrally and at Tip – Velocity Triangle at Inlet and Outlet – Work

done and Efficiency.

UNIT – IV

HYDRAULIC TURBINES: Classification of Hydraulic Turbines - Pelton Wheel, Francis Turbine and Kaplan Turbine - Working Principle - Work Done and Efficiencies ofPelton Wheel, Francis Turbine and Kaplan Turbine — Draft Tube theory - Unit Quantities – Specific Speed – Performance Characteristic Curves – Model Testing.

UNIT – V

CENTRIFUGAL PUMPS: Classification of Pumps - Components – Working of a Centrifugal Pump –Work done by the Impeller on Liquid – Heads and Efficiencies – Specific Speed – Multi Stage Centrifugal Pumps – Performance Characteristic Curves.

COURSE OUTCOMES:

CO1	Able to gain basic knowledge on Fluid Statistics, Fluid Dynamics, closed conduit flows.
CO2	Ability to analyze fluid flow problems with the application of the momentum and energy equations and compute drag and lift coefficients using the theory of boundary layer flows.
CO3	Able to know the applications of momentum principles in all power plants.
CO4	Acquire knowledge on the selection of hydraulic turbines for practical purposes and also able to prepare prototype models.
CO5	Able to have thorough knowledge on selection of pumps for practical purposes.

TEXT BOOKS

1. Hydraulics and Fluid Mechanics by P.N. Modi and S.M. Seth.
2. Fluid Mechanics and Hydraulic Machines by R.K.Rajput.
3. Fluid Mechanics and Hydraulic Machines by R.K.Bansal.

REFERENCE BOOKS

1. Fluid Mechanics by V.L. Streeter and E.Benzamine, Wylie.
2. Fluid Mechanics and Turbo machines by Madan Mohan Das.– PHI Learning Pvt.Ltd., New Delhi.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

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MET 08 MACHINE DRAWING

Lectures/Week : 1 period
Drawing: 3 periods

Credits: 03
Sessionals: 20 +20
End Examination Marks: 60

COURSE OBJECTIVES:

- To understand and apply national and international standards while drawing machine component.
- To understand the concept of various tolerances and fits used for component design
- To familiarize in drawing assembly, orthographic and sectional views of various machine components.

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.

COURSE OUTCOMES:

CO1	Draw orthographic projections of lines, planes and solids
CO2	Identify and design different machine elements for joining purposes
CO3	Identify and draw the couplings and riveted joints
CO4	able to construct an assembly drawing using part drawings of machine components
CO5	Able to construct an part drawings using assembly drawing of machine components

TEXT BOOKS:

1. Narayana K.L, Kannaiah P. and Venkata Reddy K.: Production Drawing, First Edition, New Age International, 2005.
2. Narayana K.L, Kannaiah P. and Venkata Reddy K.**:** Machine Drawing, Third Edition, New Age International, 2006.

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	1	1	2									
CO2	2		2	2								
CO3		1		2	2							
CO4			2	2	3							
CO5		1	1	2								

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

CEP 42 Fluid Mechanics and Hydraulic Machinery Laboratory

Practicals/Week : 3periods

Credits: 2
Sessionals: 20 +20
End Examination Marks: 60

COURSE OBJECTIVES:

- Enrich the concept of fluid mechanics and hydraulic machines.
- Demonstrate the classical experiments in fluid mechanics and hydraulic machinery.
- Correlate various flow measuring devices such as Venturimeter, orifice meter and notches etc.
- Discuss the performance characteristics of turbines and pumps

List of Experiments:

1. Discharge Measurements:
   (a) Small Orifice
   (b) Venturi Meter
   (c) Orifice Meter
   (d) Triangular Notch

2. Losses in Pipes:
   (a) Pipe Friction
   (b) Sudden Contraction
   (c) Gate Value

3. Determination of Efficiency in Pumps and Turbines:
   (a) 0.4 K.W Centrifugal Pump
   (b) 0.8 K.W Centrifugal Pump
   (c) 5.5 K.W Centrifugal Pump

COURSE OUTCOMES:

CO1	Able to utilize the knowledge in the design of water supply pipe networks and measure the rate of flow in pipes and channels.
CO2	Able to identify suitable pumps and turbines for different working conditions.
CO3	Able to conduct experiments (in teams) in pipe flows and open-channel flows and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports
CO4	Analyze a variety of practical fluid-flow devices and utilize fluid mechanics principles in design
CO5	Gain exposure to modern computational techniques in fluid dynamics.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

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

EEP 43 ELECTRICALS ENGINEERING LABORATORY

Practicals/Week : 3periods

Credits: 2
Sessionals: 20 +20
End Examination Marks: 60

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

COURSE OBJECTIVES:

- Implement different circuits and verify circuit concepts for DC circuits.
- Measure the impedance of series RL, RC and RLC circuits.
- Prove the various theorems used to reduce the complexity of electrical network.
- The operation and characteristics of AC machines and DC machines.

ELECTRICAL

1. Verification of KVL and KCL
2. Load test on D.C Shunt Motor
3. Load test on 3 Phase Induction Motor
4. SwinBurn`s test
5. OC and SC Test on Single Phase Transformer
6. Operating Characteristics of DC Generator
7. Load test on single phase transformer
8. Load test on DC motor
9. Speed control of DC Motor
10. Single phase power measurement

COURSE OUTCOMES:

CO1	Understand the construction, operating principle and characteristics of DC machine, single phase transformer and three phase induction motor.
CO2	Prepare circuits for starting and speed control of DC machine and three phase induction motor.
CO3	Learn the basic principles involved in power generation, transmission &distribution.
CO4	Ability to understand and analyze DC Generator
CO5	Able to verify the electrical circuits and perform tests on various devices.

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

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

ECP 42 ELECTRONICS ENGINEERING LABORATORY

Practicals/Week : 3periods

Credits: 2
Sessionals: 20 +20
End Examination Marks: 60

COURSE OBJECTIVES:

- To be exposed to the characteristics of basic electronic devices
- Model the electronic circuits using tools such as PSPICE
- To introduce basic semiconductor devices, their characteristics and application
- To understand analysis and design of simple diode circu
- To learn to analyze the PN junction behavior at the circuit level and its role in the operation of diodes and active device

List of experiments

1. (a) PN Junction diode

   (b) Zener Diode

2. Half wave rectifier (with and without filter)
3. Full wave rectifier (with and with out filter)
4. BJT – CB configuration input and output characteristics
5. BJT – CE configuration input and output characteristics
6. JFET – Characteristics (Calculation of μ, rd and g_m)
7. CRO – Measurement of amplitude, frequency of given waveform

   - Measurement of Phase difference between two waveforms

8. RC Phase shift oscillator
9. Microprocessor : Introduction to programming

   Programs on

   - Addition

- Subtraction
- Division
- Multiplication
- Largest and smallest of given numbers

COURSE OUTCOMES:

CO1	Able to explain the characteristics of semiconductor devices
CO2	Describe Architecture, Programming & Interfacing of peripheral with Microprocessor.
CO3	Design different electronics circuits using amplifiers and oscillators.
CO4	Demonstrate different applications of diode- clipper, clamper, full wave rectifier and half wave rectifier
CO5	Able to explain operation and characteristics of JFET & BJT and analyze simple circuits

MAPPING OF COURSE OUTCOMES WITH PROGRAM OUTCOMES:

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

Department of Mechanical Engineering
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COT 02 MANAGERIAL ACCOUNTANCY

Lectures/Week : 2 periods

Credits: 02
Sessionals: 20 +20
End Examination Marks: 60

COURSE OBJECTIVES:

CO1	Able to prepare accounting records and summarize and interpret the accounting data for managerial decisions.
CO2	Able to present and critically analyze information pertaining to accounting, management, ethical, and social issues to assist management decision making.
CO3	Apply cost management ideas in determining product/service costs and in making business decisions, with an emphasis on Activity-based Costing.
CO4	Able to understand the cost accounting terminologies and methods, their rationale of classification, and their relevance to business decisions.
CO5	Use the ideas and practices of budgeting in a business decision-making context, with an emphasis on flexible budgeting, standard costing, variance analysis, and performance management, and their inherent problems.

UNIT – I

Management Accounting – Definition, Objectives, Scope and Functions. Financial Accounting – Introduction, Process, Principles and Concepts. Brief introduction to Trading Account, Balancing Process, Profit & Loss Account and Balance Sheet.

UNIT – II

Financial Statement Analyses – Ratio Analysis
Methods of Depreciation – Straight line, Depletion, Machine Hour Rate, Diminishing Balance, Sum of Digits and Sinking Fund.

UNIT – III

Capital Budgeting – Concept of Pay Back Period, NPV, and IRR Methods.
Unit costing – Introduction, Direct Cost Classification and Indirect Cost Classification
Introduction to Process Costing, Job Costing and Activity Based Costing.

UNIT – IV

Marginal Costing – Introduction, Definition, Meaning and BEP Analysis and BEP in units.
Standard Costing – Introduction, Variance Analysis Material Cost Variance, Material Price Variance, Labor Variance, and sales Variance.

UNIT – V

Budgetary Control – Introduction and Classification of Budgets, Production, Material/Purchase, Sales,

Sales Overhead, Cash and Factory Overheads Budgets. Flexible Budget

Course Outcomes:

CO1	Accounting records and summarize and interpret the accounting data for managerial decisions.
CO2	Critically analyze information pertaining to accounting, management, ethical, and social issues to assist management decision making.
CO3	Cost management ideas in determining product/service costs and in making business decisions, with an emphasis on Activity-based Costing.
CO4	Cost accounting terminologies and methods, their rationale of classification, and their relevance to business decisions.
CO5	Ideas and practices of budgeting in a business decision-making context, with an emphasis on flexible budgeting, standard costing, variance analysis, and performance management, and their inherent problems.

Text Book

1. **Pandikumar MP**: Management Accounting, Theory and Practice, 1st Edition, Excel Books, 2007

Reference Book

1. **Khan M Y&Jain P K**: Management Accounting 4th Edition, Tata McGraw-Hill, 2007

Mapping of Course Outcomes with Program Outcomes:

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

Department of Mechanical Engineering
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MET 09 MECHNAICAL MEASURMENTS AND METROLOGY

Lectures/Week : 3 periods

Credits: 03
Sessionals: 20 +20
End Examination Marks: 60

CO1	Able to know the terms of the measurements, and understand the principle of operation of an instrument, Choose Suitable measuring instruments for a particular application and Apply ethical principles while measuring dimensions.
CO2	Apply the principles of instrumentation for transducers & measurement of non-electrical parameters like pressure and vacuum in mechanical engineering applications for sustainable development.
CO3	Apply the principles of limits, fits, tolerance and analyze the process alignment testing of machine tools for manufacturing field.
CO4	Able to use instruments for linear and angular measurement
CO5	Have knowledge about different measurement methods and instruments, both traditional and modern that is used in the industry to measure product dimensions, shape and surface structure.

Unit-I

Basic concepts: Introduction, Definition of terms – Span and Range, Readability, Sensitivity, accuracy, Precision, Threshold, Resolution and Hysterisis – Calibration standards. The generalized measurement system. Basic concepts in dynamic measurement – amplitude response, frequency response, phase response, delay time and time constant.
Analysis of experimental data and types of experimental errors. Combination of component errors in overall system accuracy. Method of least squares, Graphical analysis and curve fitting.

Unit-II

Transducers – Introduction, Loading of the Signal Source, Impedance matching, Electric transducer elements – advantages Variable resistance, Differential transformer, Capacitance, Piezoelectric and Ionization transducer.
Measurement of Pressure and Vacuum: Pressure measurement – liquid column elements, elastic elements, very high pressure measurement. High vacuum measurement – Mcleod gauge, Pirani gauge and Thermocouple vacuum gauge.

UNIT-III

ISO system of limits, Fits and Tolerances, Interchangeability, Plain limit gauges, Measurement of screw threads, major diameters, Minor diameters and effective diameter, Pitch, Limit gauges for internal and external threads, Measurement of spur gears, pitch, profile, lead, backlash, tooth thickness.

UNIT-IV

Tool maker's microscope, Straightness measurement, Slip gauges, Twisted strip mechanical comparator, Optical lever comparator, Optical projector, Sine bar, Angle gauges, Precision level, Autocollimeter, Angle dekkor, Optical dividing heads and rotary tables, Flatness measurement, Roundness measurement. Co-ordinate measuring machines.

UNIT-V

Surface Measurement: Parameters, sampling length, Specification, Stylus instruments. Acceptance tests for machine tools: Lathe, Milling machine, Radial drill, Laser equipment.
Interferometry – Types of interferometers – Laser Interferometer – Optimal Interferometer

Course Outcomes: The students will get to understand

CO1	Measurements, and understand the principle of operation of an instrument, Choose Suitable measuring instruments for a particular application and Apply ethical principles while measuring dimensions.
CO2	Principles of instrumentation for transducers & measurement of non-electrical parameters like pressure and vacuum in mechanical engineering applications for sustainable development.
CO3	Principles of limits, fits, tolerance and analyze the process alignment testing of machine tools for manufacturing field.
CO4	Use instruments for linear and angular measurement
CO5	Measurement methods and instruments, both traditional and modern that is used in the industry to measure product dimensions, shape and surface structure.

TEXT BOOKS:

1. Gupta I.C: A Text Book of Engineering Metrology, 7th Reprint, Dhanpat Rai Publications Ltd, 2000
2. Kumar D.S.: Mechanical measurements and Control Engg., Metropolitan Book Co., 1979.

REFERENCES:

1. Sirohi R.S. and Radha Krishna H.C: Mechanical measurements, 3rd Edition, New Age International, 2004.

2. Beckwith T.G: Mechanical measurements, 6th Edition, Pearson Education, India.

3. A.S.T.M.E.: Hand book of Industrial Metrology, Prentice-Hall, 1967.

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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MET 10 DYNAMICS OF MACHINERY

Lectures/Week : 4 periods

Credits: 04
Sessionals: 20 +20
End Examination Marks: 60

CO1	Able to analyze and design clutches, brakes and dynamometers.
CO2	Understand the gyroscopic effects in ships, aero planes, road vehicles and characterize & design flywheels of an IC Engine.
CO3	Able to analyze and design centrifugal governors.
CO4	Analyze balancing problems in rotating and reciprocating machinery
CO5	Understand free and forced vibrations of single degree freedom systems.

UNIT-I

FRICTION: Inclined plane ,pivot and collar, uniform pressure, uniform wear.
Friction circle and friction axis, lubricated surfaces, boundary friction, film lubrication.

CLUTCHES: Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch,

BRAKES AND DYNAMOMETERS: Simple block brakes, Band brake, internal expanding brake, braking of vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

UNIT-II

GYROSCOPIC COUPLE AND PRECESSIONAL MOTION: Gyroscopic Couple –effect of precession on stability of moving vehicles such as motor cars, motor cycles, aero-planes and ships-Gyroscopic stabilization.

TURNING MOMENT DIAGRAMS AND FLYWHEEL: Construction of crank effort and diagrams-Fluctuation of energy and speed in flywheels-flywheel of an I.C. engine. Flywheel of a punching press determination of moment of inertia - design considerations.

UNIT-III

CENTRIFUGAL GOVERNORS: Sleeve loaded and spring loaded governors. Hartnell, Hartung governors and governors with auxiliary springs - sensitiveness, Isochronism and hunting in governors. Governors effort and power-controlling force diagrams-stability, Friction and insensitiveness**.**

UNIT-IV

BALANCING: 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

VIBRATION: Free and forced vibration of single degree of freedom system, Role of damping, whirling of shafts and critical speeds. Simple problems on free, forced and damped vibrations. Vibration Isolation & Transmissibility. Transverse vibrations of beams with concentrated and distributed loads. Dunkerly's method, Raleigh's method. Torsional vibrations - two and three rotor systems..

Course Outcomes: The students will get to understand

CO1	Analyse and design clutches, brakes and dynamometers.
CO2	Gyroscopic effects in ships, aero planes, road vehicles and characterize & design flywheels of an IC Engine.
CO3	Analyse and design centrifugal governors.
CO4	Analyse balancing problems in rotating and reciprocating machinery
CO5	Free and forced vibrations of single degree freedom systems.

Text Books:

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

References:

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

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Mapping of Course Outcomes with Program Outcomes:

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

Department of Mechanical Engineering
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MET 11 IC ENGINES AND GAS TURBINES

Credits : 4

Lectures/week: 4 Hrs. Sessional Marks: 20+20

End Examination Marks:60

Course Objective:

CO1	Understand various types of I.C. Engines and identify fuel metering and fuel supply systems for different types of engines.
CO2	Analyze the effect of various operating variables on engine performance and understand normal and abnormal combustion phenomena in SI and CI engines
CO3	Able to illustrate construction, working of various types of reciprocating and rotary Compressors with performance calculations of positive displacement compressors.
CO4	Recognize and discuss today's and tomorrow's use of turbo machines for enabling a sustainable society.
CO5	Able to understand the essential components of gas turbine along with its performance improving methods and know the different types of Jet propulsive engines and Rockets.

UNIT-I

Internal Combustion Engines : classifications, principles of operation, SI and CI engines,Basic fuel supply system, ignition, cooling, lubrication and method of governing, multi cylinder engines.

UNIT-II

Testing of IC Engines: Valve and port time diagrams, indicator diagrams, testing of engines, indicated power, Brake power, efficiencies, air fuel ratio, volumetric efficiency and heat balance.

Combustion: Combustion phenomenon in diesel and petrol engines,Types of combustion chamber, Knocking& Detonation and control techniques.

UNIT-III

Reciprocating Compressors: Mechanical details, Methods of compression, shaft work and isothermal efficiency of a single stage compressor indicator diagram, effect of clearance, volumetric efficiency, losses during compression, multistage compression optimum pressure condition in two stage compression inter coolers and after coolers

UNIT - IV

Rotary Compressors: Classification, positive displacement and rotary dynamic (non-positive displacement) compressors, fans, blowers and compressors, static and total head, centrifugal compressors

velocity diagrams, type of impeller vanes, slip factor, diffuser isentropic efficiency, axial flow compressors, velocity diagrams, degree of reaction, isentropic efficiency

UNIT – V

Gas Turbines & Jet propulsions : Simple gas turbine cycle constant volume cycles, open and closed cycle, constant pressure cycle, efficiency and work output, cycle with inter coolers, reheat and regeneration practical cycles losses in a turbine

Jet Propulsion: Specific thrust, thermal efficiency and propulsion efficiency turbo prop, turbo jet, rocket propulsion, performance evaluation

Course Outcomes:

CO1	Identify various types of I.C. Engines and fuel metering and supply systems.
CO2	engine performance and understand normal and abnormal combustion phenomena in SI and CI engines effect of various operating variables.
CO3	Construction, working of various types of reciprocating and rotary Compressors with performance calculations of positive displacement compressors.
CO4	Applications of turbo machines for enabling a sustainable society.
CO5	Essential components of gas turbine along with its performance improving methods and know the different types of Jet propulsive engines and Rockets.

TEXT BOOKS:

1. Heat Engineering : Vasandani V P and Kumar D S
2. Engineering Thermodynamics : Nag P K
3. Cryogenic Engineering : Russel B Scott

4. Heat Engines : Ballaney P L
5. Internal Combustion Engines : V. Ganesan
6. Internal Combustion Engine Fundamentals : John B Heywood
7. Fundamentals of Internal Combustion Engines : Gupta H.N
8. Emissions from combustion engines and their control: Patterson D.J. and Henein N.A

REFERENCE BOOKS:

1. Applied Thermodynamics : Eastop and Mckankey

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						

Department of Mechanical Engineering
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MET 12 MATERILS SCIENCE AND METALLURGY

Lectures/Week : 4 periods

Credits: 04
Sessionals: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Analyze the Structure of materials at different levels, basic concepts of crystalline materials like unit cell, FCC, BCC, HCP, APF (Atomic Packing Factor), Co-ordination Number etc.
CO2	Understand concept of mechanical behavior of materials and calculations of same using appropriate equations
CO3	Able to explain the concept of phase & phase diagram & understand the basic terminologies associated with metallurgy. Construction and identification of phase diagrams and reactions
CO4	Able to produce materials by using different types of production processes and know the real life applications in practical cases.
CO5	Able to construct TTT diagrams and cooling curves and understand and suggest the heat treatment process & types. Significance of properties Vs microstructure. Surface hardening & its types.

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. Work hardening – mechanism and sages of work hardening. Cold working and ho working. Recovery, Recrystallization and Grain growth.

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

Production of Pig – Iron in the Blast furnace. Production of steel in Bessemer, Open Hearth and Basic Oxygen steel making. 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. Codification of steels .IS.AISI –SAE classifications. 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. Heat treatment of non- ferrous alloys-Age hardening.

Powder Metallurgy –production of metal powders- Basic steps in powder metallurgy - advantages limitations and applications of powder metallurgy. Introduction to Composite materials.

Course Outcomes: The students will get to understand

CO1	Analyze the Structure of materials at different levels, basic concepts of crystalline materials like unit cell, FCC, BCC, HCP, APF (Atomic Packing Factor), Co-ordination Number etc.
CO2	Understand concept of mechanical behavior of materials and calculations of same using appropriate equations
CO3	Able to explain the concept of phase & phase diagram & understand the basic terminologies associated with metallurgy. Construction and identification of phase diagrams and reactions
CO4	Able to produce materials by using different types of production processes and know the real life applications in practical cases.
CO5	Able to construct TTT diagrams and cooling curves and understand and suggest the heat treatment process & types. Significance of properties Vs microstructure. Surface hardening & its types.

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

Mapping of Course Outcomes with Program Outcomes:

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

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MET 13 DESIGN OF MACHINE MEMBERS –I

Lectures/Week : 4 periods

Credits: 04
Sessionals: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Understand the customers' need, formulate the problem and draw the design specifications
CO2	Able to select components as per standards and Understand component behavior subjected to loads and identify the failure criteria
CO3	able to design a machine component in fluctuating loads
CO4	able to design fasters for different mechanical purposes and identify welded joints and their failure
CO5	Able to design and analyze springs

UNIT-I

Engineering Design
What is designing? ; The process of Design; design by evolution; The Morphology of design; Identification and analysis of need; True need; Specifications ; Standards of performance ; use of checklists ; Morphological Analysis ; Brainstorming; measure of physical realizibility; Economic and financial feasibility ; Designing for shipping, handling and installation; Design for maintenance ; Detailed design

UNIT-II

Mechanical Engineering design
Traditional Design methods; Design Synthesis; design considerations and standards; Engineering classification and selection; BIS designation of steels; Mechanical properties.
Design against static load
Modes of failure; factor of safety; Stress-strain relationships; shear stress and shear strain relationships; Axial, Bending, Torsional stresses; principles stresses; Theories of failure. Design of shafts.

UNIT-III

Design against Fluctuating loads
Stress Concentration factors; Reduction of stress concentration effects ; Fluctuating stresses; fatigue Failure; Endurance limit; Notch sensitivity; Endurance limit; Soderberg and Goodman Diagrams; Modified Goodman's diagrams; Fatigue design under combined stresses. Design for finite and infinite life.

UNIT-IV

Design of fasters

Threaded joints-Thread joints; ISO metric screw threads, Bolted joint in tension; Torque requirement for bolt tightening; bolted joint under fluctuating load; eccentricity loaded bolted joints in shear; bolted joints with combined stresses; Bolt of uniform strength.

Welded joints-types of welded joints; stresses in butt and fillet welds; strength of welded joints; eccentricity welded joint; weld joint subject to bending moment and fluctuating forces; welding symbols; weld inspection.

UNIT-V

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.

Course Outcomes: The students will get to understand

CO1	Customers' need, formulate the problem and draw the design specifications
CO2	Select components as per standards and Understand component behavior subjected to loads and identify the failure criteria
CO3	To design a machine component in fluctuating loads
CO4	Design fasters for different mechanical purposes and identify welded joints and their failure
CO5	Design and analyze springs

TEXT BOOKS:

1. Lal G. K., Vijay Guptha, Venkata Reddy N.: Fundamental of Design and Manufacturing, Alpha Science International, 2005.

2. Bhandari V. B.: Design of Machine Element, Third Edition, Tata McGraw Hill, 2010.

3. Shigley J. E: Mechanical Engineering Design, Third Edition, Tata McGraw Hill, 2010.

REFERENCES:

1. Allen Strickland Hall, Alfred R. Holowenko, Herman G. Laughlin: Machine Design, Schaum Series, Tata McGraw Hill, 2010

2. Faires V.M: Design of Machine Elements, Fourth Edition, Macmillan, 1965.

3. Sharma P.C. & Aggarwal D.K.: Machine Design, S. K. Kataria & Sons, 1997.

4. Jain R.K.: Machine Design, Fifth Edition, Khanna, 1988.

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Mapping of Course Outcomes with Program Outcomes:

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

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MEP 03 MACHINE TOOLS LABORATORY

Practicals/Week : 3periods

Credits: 2
Sessionals: 20 +20
End Examination Marks: 60

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

Course Objectives:

CO1	Analyze forces, can control appropriateness for machine power according to working standards
CO2	Able to produce single point cutting tools as per standards
CO3	Able to conduct different machine alignment tests on lathe and drilling machines
CO4	Study and analyze the tool wear and indexing
CO5	Measurement of forces milling machine and analyze the impact strength of welded joints

List of Experiments:

1. Force Measurement on Lathe.
2. Power Measurement on Lathe.
3. Production of Single point cutting tool using and cutter grinder.
4. Differential Indexing.
5. Fit Exercise on Capstan Lathe.
6. Alignment Test on Lathe.
7. Alignment Test on Radial Drilling Machine.
8. Thrust and Torque Measurement in Drilling Operation.
9. Study of tool wear (flank wear)
10. Study of Weld Bead generator in Arc.
11. Measurement of Forces in Milling.
12. Study of Impact strength tests on Welding joints.

Course Outcomes:

The students will get to understand

CO1	Forces, can control appropriateness for machine power according to working standards
CO2	Produce single point cutting tools as per standards
CO3	Conduct different machine alignment tests on lathe and drilling machines
CO4	Tool wear and indexing
CO5	Measurement of forces milling machine and analyze the impact strength of 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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MEP 04 FUELS LAB

Lectures/Week : 3 periods

Credits: 2
Sessional marks: 40
End Examination Marks: 60

Course Objectives:

CO1	Analyze important fuel and lubricant properties for the application in specific exploitation conditions
CO2	Measure flash and fire point of different fuels
CO3	Able to calibrate the pressure gauges
CO4	Able to measure performance of a centrifugal blower
CO5	Able to know the working of different boilers in steam power plant

LIST OF EXPERIMENTS:

1. Measurements of Viscosity of Various Lubricating oils.
2. Test on Flash and Fire Point Apparatus.
3. Test on Carbon – Residue Apparatus.
4. Test on Distillation Apparatus.
5. Calibration of Pressure Gauge.
6. Test on Aniline Point Apparatus.
7. Test on BombCalorimeter.
8. Performance Test On A Centrifugal Blower
9. Study of Boilers.

Course Outcomes:

CO1	Analyze important fuel and lubricant properties for the application in specific exploitation conditions
CO2	Measure flash and fire point of different fuels
CO3	Able to calibrate the pressure gauges
CO4	Able to measure performance of a centrifugal blower
CO5	Able to know the working of different boilers in steam power plant

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

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MET 14 REFRIGERATION AND AIR CONDITIONING

Lectures/Week : 3 periods

Credits: 3
Sessional marks: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Able to recognize the fundamental principles of and locate various important components of the refrigeration and air conditioning system.
CO2	Have a good understanding of the principles of air conditioning design, and consideration that influence the design including human comfort, weather and environmental parameters and building structure
CO3	Comparative study of different refrigerants with respect to properties, applications and environmental issues.
CO4	Able to develop analytical cognitive skills and improve problem solving skills in air conditioning.
CO5	Acquire knowledge of heating, ventilation, and air conditioning and refrigeration controls and technical components for optimum performance.

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.

Course Outcomes: The students will get to understand

CO1	Able to recognize the fundamental principles of and locate various important components of the refrigeration and air conditioning system.
CO2	Have a good understanding of the principles of air conditioning design, and consideration that influence the design including human comfort, weather and environmental parameters and building structure
CO3	Comparative study of different refrigerants with respect to properties, applications and environmental issues.
CO4	Able to develop analytical cognitive skills and improve problem solving skills in air conditioning.
CO5	Acquire knowledge of heating, ventilation, and air conditioning and refrigeration controls and technical components for optimum performance.

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	1	1									
CO2	1			2	2							
CO3			2	3		1						
CO4		1		2								
CO5			2	2	1							

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MET 15 OPERATIONS RESEARCH

Lectures/Week : 4 periods

Credits: 04
Sessionals: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Understand the concepts of operations research modelling approaches and solve LP engineering problems
CO2	Formulate and solve engineering and managerial situations as Transportation and Assignment problems
CO3	Able to solve replacement and game theory model problems
CO4	Able to Solve inventory problems
CO5	Able to simulate simple inventory and queuing models.

UNIT-I

Introduction to general nature of operations research Models and their types
Introduction to LP Problems, examples, Graphical method of solution. Simplex Algorithm. Duality.

UNIT-II

Transportation and Assignment problems, Transhipment models and Traveling Salesman Problems

UNIT-III

Replacement models – replacement of items that deteriorate with time and group replacement of items that fail suddenly.

Game theory models – two persons zero sum games.

UNIT-IV

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.
Inventory control: ABC Analysis. Fixed order quantity, Fixed order interval systems and S-s policy.

UNIT-V

Waiting line models – Basic structure of queuing models, single server and multi server models- Stress is only on applications.
Simulation – simple models in inventory and queuing systems.

Course Objectives: The student will be able to

CO1	Understand the concepts of operations research modelling approaches and solve LP engineering problems
CO2	Formulate and solve engineering and managerial situations as Transportation and Assignment problems
CO3	Able to solve replacement and game theory model problems
CO4	Able to Solve inventory problems
CO5	Able to simulate simple inventory and queuing models.

TEXT BOOKS:

1. Vohra N. D.: Quantitative Techniques in Management, 3rd Edition, Tata Mc Graw 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.

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

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MET 16 DESIGN OF MACHINE MEMBERS – II

Lectures/Week : 4 periods

Credits: 04
Sessionals: 20 +20
End Examination Marks: 60

(Note: Use of Design data book is permitted during exam.)

Course Objectives:

CO1	Design keys, cotters, couplings and joints including riveted, bolted and welded joints.
CO2	Analyze the pressure distribution and design journal bearings.
CO3	Analyze the dynamic loads and design of rolling contact bearings.
CO4	Design different types of gears
CO5	Design belts, springs, brakes, clutches and engine parts

UNIT-I

Keys and Couplings:

Keys: Types of Keys; Design of shunk key. Effect of key way. Design of Splines.
Introduction, Types of Shaft Couplings: Design of Sleeve or muff couplings, Clamp or Compression coupling, Flange Couplings. Design of Bushed pin type flexible coupling.

UNIT-II

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 – Design of bearing caps and bolts. Heat in bearings.

Thrust Bearings: Design of footstep bearing and collar bearings.

UNIT-III

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. Reliability of a bearing. Selection of radial ball bearings. Stribeck's equation.

UNIT-IV

Gears:

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 centre cranks – Crank pins, Crank shafts.

Course Outcomes: The student will be able to

CO1	Design keys, cotters, couplings and joints including riveted, bolted and welded joints.
CO2	Analyze the pressure distribution and design journal bearings.
CO3	Analyze the dynamic loads and design of rolling contact bearings.
CO4	Design different types of gears
CO5	Design belts, springs, brakes, clutches and engine parts

TEXT BOOKS:

1. Khurmi R.S. & Gupta: Machine Design, 14th Edition, S. Chand, 2006.
2. Bandari V.B.: Design of Machine Members, 3rd Edition, Tata Mc Graw Hill, 2010.
3. Mahadevan & Balaveera Reddy: Mechanical Engineering. Design Data Hand Book, 3rd Edition, CBS Publishers and Distributors, 1995.

REFERENCES:

1. Sundararaja Murthy T.V. & Shanmugan N.: Machine Design, Anuradha Publications, 2007.
2. Sarma and Agarwal: Machine Design, 4th Edition, Katson Publications, 1984.
3. Jain R.K.: Machine Design, 5th Edition, Khanna Publications, 1988.
4. P.S.G.College of Technology: Design Data Book, PSG College of Technology, 1966.
5. Shigley J.E: Mech Engg. Design, 8th Edition, Tata McGraw Hill, 2008.
6. Pandya and Shah: Machine Design, 15th Edition, Charotar Publishing House, 2004.

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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MET 17 INDUSTRIAL ENGINEERING AND MANAGEMENT

Lectures/Week : 3 periods

Credits: 03
Sessionals: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Understand the evolutionary development of management thought and general principles of management.
CO2	Able to identify and design plant location, plant layout and material handling systems
CO3	Apply forecasting and PPC techniques to production systems
CO4	Able to reduce work duration in industries using work and time study
CO5	Able to suggest safety techniques for industries and know the concepts of factories ACTs.

UNIT – I

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

UNIT – II

Plant Location – Location factors, concept of Weber theory. 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 – III

Sales forecasting – need, Classification moving average exponential smoothing and linear regression technique.
Production Planning and Control – Objectives, Salient features of functions of PPC.

UNIT – IV

Work study – Definition, objectives and uses. Method study – definition. Objectives procedure and uses.
Time study – Definition, needs, functions, and basic concepts of break down, preventive, predictive and total productive maintenance.

UNIT – V

Safety in industry – need safety programs, accident prevention, economic aspects, causes of accidents, accident prevention.
Industrial disputes – Causes and methods of settling Labour participation in management concept. Types and advantages A brief outline of Factories Act, Industrial disputes Act and Workmen's Compensation Act.

TEXT BOOKS:

1. **Khanna O P**: Industrial Engineering And Management , 7th Edition, Dhanpat Rai & Sons, 2002
2. **Panner Selvam 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: The student will be able to

CO1	Evolutionary development of management thought and general principles of management.
CO2	Identify and design plant location, plant layout and material handling systems
CO3	Forecasting and PPC techniques to production systems
CO4	Reduce work duration in industries using work and time study
CO5	Suggest safety techniques for industries and know the concepts of factories ACTs.

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Mapping of Course Outcomes with Program Outcomes:

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

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MEP 05 I.C.ENGINES LAB

Lectures/Week : 3periods

Credits: 2

Sessional marks: 40

End Examination Marks: 60

Course Objectives:

CO1	Conduct constant speed and variable speed tests on IC engines and interpret their performance.
CO2	Estimate energy distribution by conducting heat balance test on IC engines
CO3	Evaluate the performance of turbo machines
CO4	Evaluate the performance of air compressor and blower
CO5	Able to draw valve timing and port timing diagrams of Petrol & Diesel engines.

List of Experiments:

1. Load Test and Smoke Test on I.C. Engines.
2. Morse Test on Multi-Cylinder Engine.
3. Heat balance sheet on I.C. Engines.
4. Study of Multi-Cylinder and determination of its firing order.
5. Performance Test on Air Compressor.
6. Determination of pressure distribution around the given (1) cylinder (2) airfoil specimens kept in a uniform flow wind-tunnel.
7. Study of Automobile Mechanisms.
8. Verification of laws of balancing.
9. Determination of ratios of angular speeds of shafts connected by Hooke's joint.
10. Determination of the ratio of times and ram velocities of Witworth quick return motion mechanism.
    a. To draw curves of slider displacement and crank angle and linear velocities w.r.t. times for a slider crank mechanism and compare with theoretical values.
    b. To draw the crank angle vs. pressure diagram for an I.C. engine using pressure transducer and cathode ray oscilloscope.
11. Load Test and Emission Test with 5-Gas Analysis 2 smoke meter on four stroke diesel engine with Bio-diesel fuel.

12. Performance Test on centrifugal blower.
13. Economical Speed Test on volumetric efficiency test on I.C engine.
14. Retardation Test on an I.C. Engine.
15. Air fuel ratio & volumetric efficiency test on I. C. Engine.
16. Test for optimum flow rate of cooling water for an I. C. Engine.
17. Valve Timing diagrams for Petrol & Diesel Engine cut models.
18. Port Timing diagrams for Petrol & Diesel Engine cut models

Course Outcomes:

CO1	Conduct constant speed and variable speed tests on IC engines and interpret their performance.
CO2	Estimate energy distribution by conducting heat balance test on IC engines
CO3	Evaluate the performance of turbo machines
CO4	Evaluate the performance of air compressor and blower
CO5	Able to draw valve timing and port timing diagrams of Petrol & Diesel engines.

Mapping of Course Outcomes with Program Outcomes:

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

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MEP 06 METROLOGY LAB

Practicals/Week : 3periods

Credits: 2
Sessionals: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Prepare setups and measure dimensional and geometrical features of components.
CO2	Measure surface roughness of components.
CO3	Able to do alignment tests
CO4	Able to calibrate different mechanical instruments for general purposes
CO5	Gain knowledge on different setups for measuring thread profile

1. Calibration of any two of the following instruments: (using slip gauges)
    i. Calibration of Micrometer.
    ii. Calibration of Mechanical Comparator.
    iii. Calibration of Vernier Caliper.
    iv. Calibration of Dial Gauge.
2. Measurement of taper angle using
    i. Bevel Protractor
    ii. Dial Gauge
    iii. Sine-Bar
    iv. Auto-Collimator.
3. Alignment tests:
    i. Parallelism of the spindle
    ii. Circularity & Concentricity of the spindle
    iii. Trueness of running of the spindle.
4. Gear testing:
   To find;
    i. diameter, pitch/module
    ii. pitch circle diameter
    iii. pressure angle
    iv. tooth thickness.
5. Check the straightness of a surface plate
    i. Using spirit level
        or

ii. Using Auto-collimator

6. Check the flatness of a surface plate using one of the above methods.
7. Using light wave interference:
   i. Study of flatness of slip gauges
   ii. To find the height of a slip gauge.
8. Tool Maker's Microscope:
   i. Establish the thread details
   ii. To find the cutting tool angles.
9. Miscellaneous:
   i. To find the diameter of a cylindrical piece
   ii. Taper angle of a V-block
   iii. Central distance of two holes of a specimen.

Course Outcomes: The student will be able to

CO1 Prepare setups and measure dimensional and geometrical features of components.

CO2 Measure surface roughness of components.

CO3 Able to do alignment tests

CO4 Able to calibrate different mechanical instruments for general purposes

CO5 Gain knowledge on different setups for measuring thread profile

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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MEOE 01 PROJECT MANAGEMENT

Lectures/Week : 3 periods

Credits: 03
Sessionals: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Improving knowledge and understanding of project management principles.
CO2	Develop strategies to initiate, plan, execute, monitor and control, and close projects in business environments.
CO3	Conduct project planning activities that accurately forecast project costs, timelines, and quality. Implement processes for successful resource, communication, and risk and change management.
CO4	Utilize technology tools for communication, collaboration, information management, and decision support.
CO5	Analyzes and manages stakeholder expectations and engagement to ensure a successful project outcome in future.

UNIT – I

Introduction to Project Management, Characteristics of projects. Definition and objectives of project management , Stages of project management, Project planning process, Establishing project organization.

UNIT – II

Work definition: Defining work content, Time estimation method, project cost estimation and budgeting, Project risk management, project scheduling and planning tools. Work breakdown structure, LRC, Gantt charts, CPM/PERT Networks

UNIT – III

Developing project plan (Base line), project cash flow analysis, project scheduling with resource constraints, resource leveling and resource allocation, Time cost Trade off: Crashing Heuristic

UNIT – IV

Project implementation – project monitoring and control with PERT/Cost, Computers applications in project management, project procurement management

UNIT – V

Post – project analysis

Course Outcomes: The student will be able to

CO1	Improving knowledge and understanding of project management principles.
CO2	Develop strategies to initiate, plan, execute, monitor and control, and close projects in business environments.
CO3	Conduct project planning activities that accurately forecast project costs, timelines, and quality. Implement processes for successful resource, communication, and risk and change management.
CO4	Utilize technology tools for communication, collaboration, information management, and decision support.
CO5	Analyzes and manages stakeholder expectations and engagement to ensure a successful project outcome in future.

Text Books

1. Shtub, Bard and Globerson, Project Management Engineering, technology and Implementation, PHI.
2. Lock, Gower, Project Management Handbook
3. Wiest and Levy, Management guide to PERT/CPM, PHI

Reference Books

1. Horald Kerzner, Project Management: A systematic approach to planning, scheduling and controlling, CBS Publications.
2. S. Choudary, Project Scheduling and Monitoring in Practice
3. P.K. Joy, Total Project Management, The Indian Context, Macmillan India Ltd.,

Mapping of Course Outcomes with Program Outcomes:

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

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MEOE 02 GREEN ENERGY SYSTEMS

Lectures/Week : 3 periods

Credits: 03
Sessionals: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Able to understand the instruments for measuring solar radiation and analyze the solar radiation data.
CO2	Able to understand the principles and applications of solar energy, solar energy collection, solar heating, solar distillation and photo voltaic energy.
CO3	Understand the Geothermal, Wind & Tidal energy, its mechanism of production and its applications
CO4	Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications
CO5	Able to design environmental friendly buildings through industrial wastes and natural materials.

UNIT-I

Solar Radiation: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships.

Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

UNIT – II

Solar Energy Storage And Applications: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

UNIT – III

Bio-Mass: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking,

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

Ocean Energy: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles.

UNIT –IV

Energy efficient systems

Electrical Systems: Energy efficient motors, energy efficient lighting and control, selection of luminaire,.

Mechanical Systems: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, Environmental friendly and Energy efficient compressors and pumps**.**

Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT–V

Green Buildings: Definition, features and benefits. Sustainable site selection and planning of buildings for maximum comfort. Environmental friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste, alternate roofing systems, paints to reduce heat gain of the buildings.

Course Outcomes: The student will be Understand to

CO1	Instruments for measuring solar radiation and analyze the solar radiation data.
CO2	Principles and applications of solar energy, solar energy collection, solar heating, solar distillation and photo voltaic energy.
CO3	Geothermal, Wind & Tidal energy, its mechanism of production and its applications
CO4	Concept of Biomass energy resources and their classification, types of biogas Plants-applications
CO5	Design environmental friendly buildings through industrial wastes and natural materials.

TEXT BOOKS:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/ TMH
2. Non-Conventional Energy Resources/ Khan B.H/ Tata McGraw Hill, New Delhi, 2006
3. Green Manufacturing Processes and Systems, Edited / J. Paulo Davim/Springer 2013
4. Non-Conventional Energy / Ashok V Desai /New Age International (P) Ltd
5. Renewable Energy Technologies /Ramesh & Kumar /Narosa
6. Non-conventional Energy Source/ G.D Roy/Standard Publishers

REFERENCES:

1. Alternative Building Materials and Technologies / K.S Jagadeesh, B.V Venkata Rama Reddy and K.S Nanjunda Rao/New age international
2. Principles of Solar Engineering / D.Yogi Goswami, Frank Krieth & John F Kreider / Taylor & Francis

3. Renewable Energy Resources-2nd Edition/ J.Twidell and T. Weir/ BSP Books Pvt.Ltd
4. Fuel Cell Technology –Hand Book / Gregor Hoogers / BSP Books Pvt. Ltd.

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								

MEOE 03 INDUSTRIAL ROBOTICS

Lectures/Week : 3 periods

Credits: 3
Sessional marks: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Analyze the manipulator design including actuator, drive and sensor issues
CO2	Able to understand the different types of control systems, drive mechanisms and select appropriate drive system as per industry requirements and also apply various controls as per requirement.
CO3	Identify different types of end effectors and sensors required for specific applications
CO4	Develop programming principles and languages for a robot control system.
CO5	Able to select an appropriate robot for given industrial inspection and material handling systems.

UNIT –I

Fundamentals of robotics – Automation and robotics, Robot Anatomy, Four common robot configurations – Robot motions – Robot wrist – Robot work volumes – Robot characteristics – Spatial resolution, Accuracy, Repeatability.

UNIT-II

Control Systems and components – Basic control systems components and models – Mathematical models, transfer function – Block diagrams, Characteristic equations – Controllers – Proportional control , Integral control, Proportional and Derivative (PD) control, Proportional and Integral (PI) control and PID Control – Analysis of robot joint axis – Open loop and closed loop control systems

UNIT-III

Drive systems and sensors –Servo controlled and non-servo controlled robots. Direct drive and indirect drive Drives – Hydraulic, Pneumatic and Electric drives – Robot joint control design. Types of sensors – Contact and non – contact type sensors – Position sensors – velocity sensors – force sensors – torque sensors – Tactile sensor – proximity and range sensors – Use of sensors in robotics.

UNIT-IV

Robot end – effectors – grippers and tools – Mechanical grippers – types of gripper mechanisms – gripper force analysis – vacuum grippers – magnetic grippers – Tools as end – effectors – Robotic sensory gripper – Remote centre compliance device (RCC).

UNIT-V

Robot programming and applications – programming methods – Off – line programming and on – line programming – teach box or control box, Lead through programming – Use of robot programming languages – VAL. Applications of robot – Material handling, Machine loading/unloading, Assembly, Inspection etc., Work cell layout – Robot Work cells. Economic analysis.

Course Outcomes:

CO1	Analyze the manipulator design including actuator, drive and sensor issues
CO2	The different types of control systems, drive mechanisms and select appropriate drive system as per industry requirements and also apply various controls as per requirement.
CO3	Identify different types of end effectors and sensors required for specific applications
CO4	Develop programming principles and languages for a robot control system.
CO5	Select an appropriate robot for given industrial inspection and material handling systems.

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. R.K. Mittal and I.J. Nagrath, Robotics and Control, McGraw Hill Education (India) Private Ltd., 2014.
3. Deb S.K, Deb.S,"Robotics Technology and Flexible Automation", Tata McGraw-Hill Education Private Limited, 2009.
4. Ganesh S. Hegde, A text book on Industrial Robotics, Laxmi Publications (P) Ltd., 2007.

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

Mapping of Course Outcomes with Program Outcomes:

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

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MEDE 01 MECHANIACAL VIBRATIONS

Lectures/Week : 3 periods

Credits: 3
Sessionals: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Able to solve for the motion and the natural frequency of a freely vibrating single degree of freedom undamped motion and a freely vibrating single degree of freedom damped motion.
CO2	Ability to determine vibratory responses of SDOF, TDOF and MDOF systems to harmonic, periodic and non-periodic excitation.
CO3	Able to calculate natural frequency and period of simple vibrating mechanical systems.
CO4	Able to represent the vibration phenomena as a mathematical model and solve it to obtain the response.
CO5	Able to know the process of vibration measurements & control and vibration continue systems.

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.

Course Outcomes:

CO1	Motion and the natural frequency of a freely vibrating single degree of freedom undamped motion and a freely vibrating single degree of freedom damped motion.
CO2	Ability to determine vibratory responses of SDOF, TDOF and MDOF systems to harmonic, periodic and non-periodic excitation.
CO3	Calculate natural frequency and period of simple vibrating mechanical systems.
CO4	Represent the vibration phenomena as a mathematical model and solve it to obtain the response.
CO5	Process of vibration measurements & control and vibration continue systems.

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.**

Mapping of Course Outcomes with Program Outcomes:

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

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MEDE 02 ADVANCED MANUFACTURING PROCESSES

Lectures/Week : 3 periods

Credits: 3
Sessionals: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Analyze the different elements and characteristics of Abrasive jet machining and Ultrasonic Machining and its applications.
CO2	Able to implement the chemical and electro chemical machining techniques.
CO3	Understand the working of electric discharge machining and process of beam control techniques of EBM affecting the surface finish of work pieces in medical and engineering fields.
CO4	Able to implement plasma arc and Laser beam machining processes for industrial applications.
CO5	To have exposure to recent developments in composites, including metal, polymer and ceramic matrix composites.

UNIT – I

Abrasive jet machining: Elements of the process, mechanics of metal removal process parameters, economic considerations, applications and limitations, recent developments.

Ultrasonic machining – Elements of the process, machining parameters, effect of parameters on surface finish and metal removal rate, mechanics of metal removal process parameters, economic considerations, applications and limitations.

UNIT – II

Electrochemical Processes – Fundamentals of electrochemical machining, metal removal rate in ECM, Tool design, Surface finish and accuracy and economics aspects of ECM.
Electrochemical Grinding.

UNIT – III

Wire – EDM process – General principles, and applications of Wire EDM, Mechanics of metal removal, Process parameters, and selection of tool electrode and dielectric fluids.

Electron beam machining: Generation and control of electron beam for machining, theory of electron beam machining, principle, advantages and limitations.

UNIT – IV

Plasma Arc machining – Principle, machining parameters, effect of machining parameters on surface finish and metal removal rate, applications, limitations.
Laser beam machining – Principles, effect of machining parameters on surface finish, applications, and limitations.

UNIT – V

Processing of Ceramics – Applications, Characteristics, Classification. Processing of particulate ceramics, Powder operations, Consolidation, Drying, Sintering, Hot compaction, Area of applications, finishing of ceramics, Processing of Composites, Composite layers, Particulate and fibre reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

Course Outcomes:

CO1	Analyze the different elements and characteristics of Abrasive jet machining and Ultrasonic Machining and its applications.
CO2	Implement the chemical and electro chemical machining techniques.
CO3	Understand the working of electric discharge machining and process of beam control techniques of EBM affecting the surface finish of work pieces in medical and engineering fields.
CO4	Implement plasma arc and Laser beam machining processes for industrial applications.
CO5	To have exposure to recent developments in composites, including metal, polymer and ceramic matrix composites.

Text Books

1. Serope Kalpakjian: Manufacturing Engineering and Technology, 5th Edition, Pearson Prentice Hall
2. P.C. Sharma: A Textbook of Production Technology: Manufacturing Process, 7th Edition, S. Chand & Company Limited, 2007
3. **Haslehurst M.:** Manufacturing Technology, Third Edition, Viva Books Pvt. Ltd., 1998
4. **Gupta S.C. and Jain.R.K:** Production Technology, Ninth Edition, Khanna Publishers, 2002

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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MEDE 03 NON-CONVENTIONAL ENERGY SOURCES

Lectures/Week : 3 periods

Credits: 3
Sessional marks: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Able to study various non-conventional sources of energy like wind, biomass etc and its applications in remote areas of the country.
CO2	Able to understand the instruments for measuring solar radiation and analyze the solar radiation data.
CO3	Able to understand the principles and applications of solar energy, solar energy collection, solar heating, solar distillation and photo voltaic energy.
CO4	Understand the Geothermal, Wind & Tidal energy, its mechanism of production and its applications
CO5	Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications

UNIT-I

Introduction: Role and potential of new and renewable sources, The solar energy option, Environmental impact of solar power.
Principles of Solar Radiation: Physics of the sun, The solar constant, Extraterrestrial and Terrestrial solar radiation, Solar radiation on tilted surface, Instruments for measuring solar radiation and sun shine, 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.

Geothermal Energy: Resources, Types of wells, Methods of harnessing the energy, Potential in India.

UNIT-IV

Energy from Oceans: Tidal energy. Tides.Diurnal and semi-diurnal nature, Power from tides, Wave Energy, Waves, Theoretical energy available. Calculation of period and phase velocity of waves, Wave power systems, Submerged devices. Ocean thermal Energy, Principles, Heat exchangers, Pumping requirements, Practical considerations.

UNIT- V

BIO- ENERGY: Biomass energy sources. Plant productivity, Biomass wastes, aerovic andAnaerobic bioconversion processed, Raw metrical and properties of bio-gas, Bio-gas plant technology and status, the energetics and economics of biomass systems, Biomass gasification

Course Outcomes:

CO1	Various non-conventional sources of energy like wind, biomass etc and its applications in remote areas of the country.
CO2	Instruments for measuring solar radiation and analyze the solar radiation data.
CO3	Principles and applications of solar energy, solar energy collection, solar heating, solar distillation and photo voltaic energy.
CO4	Geothermal, Wind & Tidal energy, its mechanism of production and its applications
CO5	Concept of Biomass energy resources and their classification, types of biogas Plants-applications

TEXT BOOKS:

1. RaiG.D. : Non-conventionalEnergy Sources, Standard PublishersDistributors.
2. Ashok V Desai : Non-conventionalEnergy, New Age International.
3. K. Udayakumar, M. Anandakrishnan: Renewable Energy Technologies, Narosa, 1997.
4. Renewable Energy Resources- Basic Principles and Applications- G.N.Tiwari and M.K.Ghosal, Narosa Pub.
5. Renewable Energy Resources/ John Twidell& Tony Weir
6. Biological Energy Resources/ Malcolm Fleischer & Chris Lawis.
7. Kothari D.P., “Renewable energy resources and emerging technologies", Prentice Hall of India Pvt. Ltd.

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.

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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								

MET 18 ANALYSIS AND CONTROL OF PRODUCTION SYSTEMS

Lectures/Week : 3 periods

Credits: 3
Sessional marks: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Understand production systems and their characteristics.
CO2	Able to identify and design facility location and layout
CO3	Analyze aggregate planning strategies.
CO4	Apply forecasting and scheduling techniques to production systems.
CO5	Develop network diagrams for planning and execution of a given project.

UNIT –I

The Production Paradigm – Production as a System – Types of Production Systems – Job type, Batch type, flow type and Project type – Group technology – Lean and Agile manufacturing

UNIT –II

Facility Location and Layout – Multi plant location – Locational dynamics – use of REL charts and Travel charts – Computer based layout technique viz. CRAFT, CORELAP etc.

UNIT –III

Planning – Manufacturing and Service Strategies – Aggregate Planning – Graphical Analysis - Forecasting – Moving Average, Exponential Smoothing. Assembly Line Balancing – Heuristics for Line Balancing.

UNIT –IV

Operations Scheduling – Job shops and flow shops: Sequencing n jobs – 2 machines, n jobs 3 machines, n jobs m machines – 2 jobs m machines. Priority Scheduling rules – Criteria and effectiveness – “Traveling salesman” Problem.

UNIT –V

Controlling – Project planning and Controlling with PERT / CPM – MRP, JIT, KANBAN systems – LOB technique – MRP-II

Course Outcomes: The student will be able to

CO1	Production systems and their characteristics.
CO2	Identify and design facility location and layout
CO3	Analyze aggregate planning strategies.
CO4	Apply forecasting and scheduling techniques to production systems.
CO5	Develop network diagrams for planning and execution of a given project.

TEXT BOOKS:

1. Adam and Ebert : Production and Operations Management, 5th Edition, Prentice Hall, 1992.
2. Buffa E S : Modern Production Management, 8th Edition, Wiley-India, 2010.

REFERENCES:

1. Groover M.P.: Automation, Production Systems and CIM, 3rd Edition, Prentice Hall, 2007.
2. Joseph Monks: Operations Management, 3rd Edition, McGraw-Hill, 1987.
3. Seetharama L. Narasimhan, Dennis W. McLeavey, Peter Billington: Production Planning and Inventory Control, 2nd Edition, Prentice Hall, 1995.
4. Elsayed A. Elsayed, Thomas O. Boucher:Analysis and Control of Production Systems, 2nd Edition, Prentice Hall, 1994.

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						
CO4			1	2			1					
CO5		1		2		3						

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MET 19 TOOL DESIGN

Lectures/Week : 4 periods

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

Course Objectives:

CO1	Design single point and multipoint cutting tools
CO2	Able to find out the tool wear using different techniques and also select cutting fluids to reduce the heat
CO3	Able to select cutting tool materials for different operations
CO4	Select and design progressive, compound or combination dies for press working operations
CO5	Design jigs and fixtures for conventional and Understand principles of locating and clamping systems.

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.

Course Outcomes:

CO1	Design single point and multipoint cutting tools
CO2	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 progressive, compound or combination dies for press working operations
CO5	Design jigs and fixtures for conventional and Understand principles of locating and clamping systems.

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", 1st Edition,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.

Mapping of Course Outcomes with Program Outcomes:

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

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MET 20 AUTOMOBILE ENGINEERING

Lectures/week: 3 Hrs.

Credits: 3
Sessional Marks: 20+20
End Examination Marks: 60

Course Objectives:

CO1	Able to know the concepts of different types of engines and their parts
CO2	Able to select air cleaners and carburettors for petrol and diesel engines
CO3	Acquire knowledge on cooling systems, lubrication systems and ignition systems of SI and CI engines
CO4	Design clutches and gear boxes for small vehicles
CO5	Able to select different steering mechanisms and brakes for smooth moving of vehicle

Unit-I

Introduction

Components of four wheeler automobile – chassis and body – power transmission – rear wheel drive, front wheel drive – types of engines, engine construction, turbo charging and super charging – engine lubrication, splash and pressure lubrication systems, Arrangement of cylinders, types valve arrangements, Liners- dry and Wet type, function and constructional details, combustion chambers for petrol and diesel engines.

Unit-II

Fuel Supply System:

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

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

Emission from Automobiles: Pollution standards, 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

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.

Course Outcomes: The student will be able to Understand

CO1	Concepts of different types of engines and their parts
CO2	Select air cleaners and carburetors for petrol and diesel engines
CO3	Knowledge on cooling systems, lubrication systems and ignition systems of SI and CI engines
CO4	Design clutches and gear boxes for small vehicles
CO5	Select different steering mechanisms and brakes for smooth moving of vehicle

TEXT BOOKS:

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

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					

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MET 21 FINITE ELEMENT METHOD

Lectures/Week : 4 periods

Credits: 4
Sessionals: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Interpret the philosophy behind principles, design and modelling considerations in using finite element analysis.
CO2	Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi symmetric and dynamic problems and solve them displacements, stress and strains induced.
CO3	Implement the formulation techniques to solve two-dimensional problems using triangle and quadrilateral elements.
CO4	Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.
CO5	Able to simulate simple CFD models and analyze its results.

UNIT-I

Basic Concepts of the Finite Element Method – Introduction, How does the FEM work – Comparison of Finite Element and Exact Solutions and Comparison of Finite Element and Finite Difference Methods. A General Procedure for Finite Element Analysis – Pre-Procession, Solution and Post-Processing. Brief History of Finite Element Method, Examples of Finite Element Analysis.

UNIT-II

Approximate Methods of Analysis : Approximate Methods – Methods of Weighted Residuals , Method of point collocation, Method of Least Squares, Galerkin`s Method, Rayleigh Ritz Method – Relation between FEM and Rayleigh Ritz Method.

Different Approaches in FEM: General Steps in FEM – Direct Approach- Variational Approach – Energy approach – Weighted Residual Approach.

UNIT-III

Finite Element and Interpolation Functions: Interpolation Functions – One Dimensional Elements – Line Element, Quadratic Element, Cubic Interpolation Function, Lagrangian Form of Interpolation Function – Two Dimensional Elements – Triangular Element, Triangular Element Quadratic function, Cubic interpolation function – Rectangular Element

UNIT-IV

One Dimensional Finite Element Analysis : Linear Spring Element, Truss Element, Space truss, one dimensional Torsion of a circular shaft, Steady state Heat conduction. Beam Element , Analysis of Plane

Frames

UNIT-V

Two Dimensional Finite Element Analysis : Two Dimensional Stress Analysis – Review of Theory of Elasticity, Application of three dimensional equation for Two dimensional analysis, CST Element for Plane stress and Strain Analysis

Course Outcomes:

CO1	Interpret the philosophy behind principles, design and modelling considerations in using finite element analysis.
CO2	Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi symmetric and dynamic problems and solve them displacements, stress and strains induced.
CO3	Implement the formulation techniques to solve two-dimensional problems using triangle and quadrilateral elements.
CO4	Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.
CO5	Able to simulate simple CFD models and analyze its results.

TEXT BOOKS

1. Chnandrupatla T.R.& Belegundu A.D.: Introduction to Finite Elements in Engineering, 1st Edition, Universities Press, 2010.
2. Desai YM, Eldho TI, AH Shah, Finite Element Method with application in Engineering, Pearson Publications-2011.

REFERENCES

1. Klaus-Jurgen Bathe: Finite Element Procedures, 2nd Edition, Prentice Hall, 1996.
2. Reddy J.N.: An Introduction to Finite Element Method, Springer Publication, 2010.

David V. Hutton.: Fundamentals of Finite Element Analysis, Tata McGraw-Hill Education, 2009

Mapping of Course Outcomes with Program Outcomes:

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

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MET 22 HEAT TRANSFER

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

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

Course Objectives:

CO1	Understand principles of different modes of heat transfer processes.
CO2	Formulate and solve conduction and convective heat transfer problems.
CO3	Estimate and solve radiation problems of black, gray and opaque bodies.
CO4	Understand current challenges in the field of convective heat transfer.
CO5	Evaluate energy requirements for operating a flow system with heat exchanger.

UNIT – I

General Modes 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, conduction through slabs, cylinders and spheres, Homogeneous and composite, 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 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: Physical mechanism, radiation properties, concept of black body – gray body – Planck's Law, Stephan Boltzmann law, Radiation shape factor relations, Heat exchange between black bodies, heat exchange between non-black bodies, introduction to radiation network analysis

UNIT – IV

Convection

Heat transfer due to free convection: Free convection heat transfer on a vertical flat plate, Empirical relations free convection from vertical planes and cylinders, horizontal planes and cylinders

Heat transfer due to forced convection: Principles of convection, 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, overall heat transfer coefficient, fouling factors, types of heat exchangers, log mean temperature difference, 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, heat transfer calculations, fin efficiency, fin effectiveness

Course Outcomes:

CO1	Understand principles of different modes of heat transfer processes.
CO2	Formulate and solve conduction and convective heat transfer problems.
CO3	Estimate and solve radiation problems of black, gray and opaque bodies.
CO4	Understand current challenges in the field of convective heat transfer.
CO5	Evaluate energy requirements for operating a flow system with heat exchanger.

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	1	1				2	2					
CO2		1		2		1	1					
CO3		2			1		2					
CO4				1	1		2					
CO5	1			1	2		1					

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

MEP 07 HEAT TRANSFER AND DYNAMICS LAB

Lectures/Week : 3periods

Credits: 2
Sessional marks: 40
End Examination Marks: 60

Course Objectives:

CO1	Estimate heat transfer coefficient in forced convection.
CO2	Measure heat transfer coefficient in free convection and correlate with theoretical values.
CO3	Estimate the effective thermal resistance in composite slabs and efficiency in pin-fins.
CO4	Determine surface emissivity of a test plate.
CO5	Able to design refrigeration and control systems

List of Experiments:

1. Test on Conduction in Composite Slab System.
2. Test on Thermal Conductivity of Solids.
3. Test on Thermal Conductivity of a Metal Rod.
4. Test on Emmissivity Measurement Apparatus.
5. Test on Lagged Pipe Apparatus.
6. Test on Steffan-Boltzman Apparatus.
7. Test on Concentric Tube Fin Type-Heat Exchanger.
8. Test on Natural Convection Apparatus.
9. Test on Forced Convection Apparatus.
10. Test on Drop-wise Condensation Apparatus.
11. Test on Vapour Compression Refrigeration System.
12. Test on Air-Conditioning Test Rig.
13. Test on Gyroscopic Unit.
14. Test on Balancing of Reciprocating Masses.
15. Test on Critical Speed Analyzer.
16. Test on Vibration Test Rig.
17. Test on Cam Apparatus.
18. Study on Instrumentation
    a. Strain Measurement Module.
    b. Torque Measurement Module.
    c. Load Cell.
    d. Pressure Measurement.
19. Calibration of Pressure Gauge.

Course Outcomes:

CO1	Estimate heat transfer coefficient in forced convection.
CO2	Measure heat transfer coefficient in free convection and correlate with theoretical values.
CO3	Estimate the effective thermal resistance in composite slabs and efficiency in pin-fins.
CO4	Determine surface emissivity of a test plate.
CO5	Able to design refrigeration and control systems

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
S. V. University College of Engineering:: TIRUPATI

ECP 43 MAT LAB

Lectures/Week : 3periods

Credits: 2
Sessionals: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Use MATLAB effectively to analyze and visualize data.
CO2	Apply numeric techniques and computer simulations to solve engineering-related problems.
CO3	Apply a top-down, modular, and systematic approach to design, write, test, and debug sequential MATLAB programs to achieve computational objectives.
CO4	Design and document computer programs and analyses in a careful and complete manner so as to effectively communicate results, to facilitate evaluation and debugging by another programmer, and to anticipate and resolve user errors.
CO5	Create and control simple plot and user-interface graphics objects in MATLAB.

Basics of MATLAB:

Basic features, script M-files, arrays and array operations, multidimensional arrays, and logical operators, control flow function, Matrix algebra and solutions to systems of linear equations, polynomials.

Matlab graphics and Numerical techniques:

Two dimensional graphics, three dimensional graphics, interpolation, curve fitting, Numerical integration, numerical differentiation.

Symbolic Mathematics:

Symbolic algebra, equation solving, differentiation and integration

Course Outcomes:

CO1	Use MATLAB effectively to analyze and visualize data.
CO2	Apply numeric techniques and computer simulations to solve engineering-related problems.
CO3	Apply a top-down, modular, and systematic approach to design, write, test, and debug sequential MATLAB programs to achieve computational objectives.
CO4	Design and document computer programs and analyses in a careful and complete manner so as to effectively communicate results, to facilitate evaluation and debugging by another programmer, and to anticipate and resolve user errors.
CO5	Create and control simple plot and user-interface graphics objects in MATLAB.

TEXT BOOKS:

1. Venkateshmurthy M.G.: Introduction to UNIX and Shell Programming, Pearson Education India, 2009.
2. Mohammad Azam: Unix In Easy Steps, New Age International, 2008.
3. Hanselman and Littlefield: Mastering Matlab 7, 1st Edition, Prentice Hall, 1997.
4. Etter, Kuncickly, Hull: Introduction to Matlab 6, 2nd Edition, Pearson Education, 2004.

Mapping of Course Outcomes with Program Outcomes:

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

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

MEOE 04 QUALITY CONTROL AND RELIABILITY ENGINEERING

Lectures/Week : 3 periods

Credits: 3
Sessionals: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Acquire knowledge on basic concepts of quality control and different types of control charts
CO2	Graduates will be aware of process capabilities in assemblies and able to select control limits.
CO3	Gain insight knowledge on consumer risks and effectively generate sampling plans.
CO4	An ability to use the techniques, skills, and modern engineering tools necessary for Quality Control and Reliability Engineering.
CO5	Acquire knowledge on TQM, six sigma concepts and ISO standards

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.

Course Outcomes:

CO1	Acquire knowledge on basic concepts of quality control and different types of control charts
CO2	Graduates will be aware of process capabilities in assemblies and able to select control limits.
CO3	Gain insight knowledge on consumer risks and effectively generate sampling plans.
CO4	An ability to use the techniques, skills, and modern engineering tools necessary for Quality Control and Reliability Engineering.
CO5	Acquire knowledge on TQM, six sigma concepts and ISO standards

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) :
3. Srinath, L.S., "Reliability Engineering", Affiliated East west press, 1991

Mapping of Course Outcomes with Program Outcomes:

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

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

MEOE 05 POWER PLANT ENGINEERING

Lectures/Week : 3 periods

Credits: 3
Sessionals: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Able to know the different types of Power Plants, site selection criteria of each one of them.
CO2	Able to select boilers, ash handling systems, draft systems and water treatment process for industrial needs.
CO3	Understand the construction and working of steam turbines, condensers, cooling towers and governing systems.
CO4	Able to design feed water system accessories and choose appropriate instruments for measuring the flow, temperature, etc.
CO5	Acquire knowledge of Different types of Nuclear power plants including Pressurized water reactor, boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor.

UNIT-I

Steam Power Plants: Introduction, flow diagram of steam power plants.

Cycles: Reheat, Regeneration, Binary Vapour cycle.

Fuel Supply and Analysis: Coal types, Coal sampling, Proximate analysis, Ultimate analysis, Ash, fusion temperature, Grind ability, Coking and coking characteristics, weathering index, reporting of coal analysis, Fuel oil and its analysis, Gaseous fuels.

Fuel System: Mechanical stokers, Pulverized fuel fired furnace, Cyclone furnace, Oil fired system, Supply, handling, storage and preparation of fuels.

UNIT-II

Water Treatment: Impurities in Water and their effects, Water treatment,Internal boiler treatment, Carryover,Blowdown.

Steam Generators: Classification, Arrangement of heat absorbing surfaces, boiler drum, internal circulation principles, modern trends in boiler, design, furnace construction, steam generator rating, boiler regulation,superheaters,reheaters, economizer and air heaters, types, location, construction and arrangement.

Ash Handling: Dust emissions from boiler furnaces,flyash separators, hydraulic and pneumatic systems of ash handling.

Draft Systems: Draft systems- fan characteristics and selection, draft control, fan drives.

UNIT-III

Steam Turbines: Types and arrangement, Construction and Operation, Governing and Lubrication.
Condensers: Types, Surface condenser, Steam and Water flow arrangement, Construction and materials, Condenser auxiliaries, Steam jet air ejectors, Mechanical Vacuum pumps, Supply of condensing Water, Cooling towers, Circulating Water Pumps.

UNIT-IV

Feed Water System: Feed Water heating cycle, Heater types, heater construction and operation,deaerators, evaporators, condensate and boiler feed pumps.

Instruments and Control: Fuel measurement, flow recorders for feed water, air steam temperature and pressure recorders, draft indicators, drum level indicators, feed water control, combustion control.

UNIT-V

Nuclear Power Plants (brief treatment only): Nuclear physics, the atomic nature of matter, nuclear structure, radioactive decay, transmutation, nuclear fission, nuclear fusion.

Nuclear Reactor Engineering: Basic principles, types of reactors, properties of nuclear fuels, moderators, coolants, control and safety rods, structural materials, radiation hazards, shielding,radioactive waste disposal.

Course Outcomes:

CO1	Able to know the different types of Power Plants, site selection criteria of each one of them.
CO2	Able to select boilers, ash handling systems, draft systems and water treatment process for industrial needs.
CO3	Understand the construction and working of steam turbines, condensers, cooling towers and governing systems.
CO4	Able to design feed water system accessories and choose appropriate instruments for measuring the flow, temperature, etc.
CO5	Acquire knowledge of Different types of Nuclear power plants including Pressurized water reactor, boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor.

TEXT BOOKS:

1. AroraS.C.&Domkundwar S.: A Course in Power Plant Engineering, 3rd Edition, DhanpatRai, 1988.
2. Nag P.K ,"Power Plant Engineering". Third edition Tata McGraw- Hill ,2007
3. G.D.Rai, "Introduction to Power Plant technology" Khanna Publishers, 1995
4. G.R,Nagpal , "Power Plant Engineering", Khanna Publishers 1998
5. K.K.Ramalingam , " Power Plant Engineering ", Scitech Publications, 2002
6. Combined Power Plants by J.H.HorlockPergamon Press

REFERENCES:

1. Skrotzki&Vopat: Power Station Engineering and Economy,Tata McGraw-Hill Education, 2009.
2. Gaffert: Steam Power Stations, 4th Edition, McGraw-Hill, 1952.
3. Openshaw Taylor: Nuclear Power Plant, 1st Edition, Philosophical Library, 1960.

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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MEOE 06 ENGINEERING SYSTEM ANALYSIS AND DESIGN

Lectures/Week : 3 periods

Credits: 3
Sessionals: 20 +20
End Examination Marks: 60

Course Objectives:

CO1	Able to gather data to design and analyze the requirements of system components and environments.
CO2	An ability to analyze a problem, and identify corresponding networking techniques to get appropriate solution.
CO3	An ability to design, implement, and evaluate a computer-based management system, process, component, or program to meet desired needs
CO4	Able to apply the object-oriented approach to systems development and become functionally knowledgeable of UML modeling techniques and tools
CO5	Successfully tackle mini-cases and respond to real-life ethical issues in engineering systems.

UNIT – I

Introduction – Systems, Elements of a system, Types of systems, Subsystems, Super systems, Need for system analysis and design, CASE tools for analysis and its limitations.

UNIT – II

System analysis – Methods of system analysis, system development life cycle, structured approach, development tools, database and networking techniques.

UNIT – III

System design – Design technologies, design principles. Design tools and methodologies, feasibility survey conversion and testing tools, design management and maintenance tools.

UNIT – IV

Object oriented analysis and design – Introduction, Object modeling, Dynamic modeling, functional modeling,, UML diagrams and tools.

UNIT – V

Case studies – Developing prototypes for systems like online exam management, computer gaming and online website management.

Course Outcomes:

CO1	Able to gather data to design and analyze the requirements of system components and environments.
CO2	An ability to analyze a problem, and identify corresponding networking techniques to get appropriate solution.
CO3	An ability to design, implement, and evaluate a computer-based management system, process, component, or program to meet desired needs
CO4	Able to apply the object-oriented approach to systems development and become functionally knowledgeable of UML modeling techniques and tools
CO5	Successfully tackle mini-cases and respond to real-life ethical issues in engineering systems.

Text Books

1. Perry Edwards, System analysis and design, McGrawHill Intrl. Edition, 1993.
2. Len Fertuck , System analysis and design with CASE tools , Wm C Brown Publishers, 1992.

Reference Text Books

1.Er.V.K. Jain, System analysis and Design , Dreamtech press
2. Kenneth E Kendall and Julie E Kendall , System analysis and design, PHI, 2007.

Mapping of Course Outcomes with Program Outcomes:

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

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MET 23 CAD AND CAM

Lectures/Week : 3periods

Credits: 3
Sessional marks: 20 +20
End Examination Marks: 60

Course Objectives

obj.1. Be familiar with drawing of 2-D entities like lines, rectangle, Parallelogram polygon, circle etc., under Draw tools entity menu using CAD software.

obj.2. Be able to draw 2-D models (Using Modify tools such as Erase, copy, offset, etc., commands)

obj.3. Be able to understand the concept of Rectangular ARRAY and Polar ARRAY

obj.4. They will be exposed to general principles and applications of geometric modeling.

obj.5. To provide information about CADD industry resources.

UNIT – I

Fundamentals of CAD – The design process – Application of Computer for design benefits of CAD – Computer configuration of CAD applications – Computer peripherals for CAD – Work station design – Graphic terminal, CAD input – output storage devices, DDA line algorithm, Bresnhams line and circle algorithms.

UNIT – II

Transformations – Points and lines location, Transformations – translation, rotation, scaling. Mirror reflection, and zooming, 2D and 3D transformations with routines – Mathematical formulations – Windowing and Clipping, perspective projections, Homogeneous Transformations, Clipping and Shielding, surface removal, hidden line algorithm and pointers algorithms.

UNIT – III

Curve generation – Plane curves – space curves – Surface description and generation; modeling concepts; 2D and 3D modeling – Wire frame, Surface and Solid modeling.
3 – D object representation, Polygon surfaces, Quadric surfaces, Spline representation, Hermite curve, Bezier curve, and B – Spline curves, Cubic polynomials, Bezier and B – Spline surfaces. Basic illustration models, Polygon – rendering methods.

UNIT – IV

Numerical Control – NC, NC Modes, NC Elements, NC machine tools and their structure, Machining centre, automatic tool changers, Turning and Milling machine centres, Controls in NC, CNC, and DNC systems. Adaptive control machining systems, Types of Adaptive Control.
CNC Part Programming – Fundamentals, Open loop and closed loop, tape formats, NC word, NC Codes, Canned Cycles, cutter radius compensation, length compensation, manual part programming, Creating

manufacturing database, Computer Assisted Part Programming using APT; Geometry statements, motion statements, PTP – Contour /Continuous interpolation methods, Post process statements, auxiliary statements, macro statement program for simple components on CNC Turning and Milling machines.

UNIT – V

Group Technology and FMS: CAPP, Retrieval type and Generative type, benefits. Machinability data systems, Computer generated time standards, Capacity planning, Shop Floor Control, Computer – Aided Quality Control, MRP – I , MRP – II, ERP, CIM concepts, topology concepts. Automated Material Handling Systems: Robot configurations and robots in material handling, Part Family. Classification and Coding, advantages and limitations. Group technology machine cells – FMC, FMG, FMS, and Agile manufacturing.

Course Outcomes:

obj.1. Be familiar with drawing of 2-D entities like lines, rectangle, Parallelogram polygon, circle etc., under Draw tools entity menu using CAD software.

obj.2. Be able to draw 2-D models (Using Modify tools such as Erase, copy, offset, etc., commands)

obj.3. Be able to understand the concept of Rectangular ARRAY and Polar ARRAY

obj.4. They will be exposed to general principles and applications of geometric modeling.

obj.5. To provide information about CADD industry resources.

References :

1. **Roy A. Plastock and Gordon** Kalley Schaum's Outline of Theory and problems of Computer Graphics, McGraw – Hill Companies Inc, 2004.
2. **Steven Harrington,** Computer Graphics – A programming approach, McGraw – Hill International Edition, 1987.
3. **David F. Rogers and J. Alan Adams**, Mathematical Elements for Computer Graphics, Tata McGraw – Hill
4. **Anirbhan Mukopadhya and Anup Chattopadhya**, Introduction to Computer Graphics and Multimedia, 2nd Edition.
5. **Ibrahim Zeid**, CAD/CAM Theory and Practice
6. **P.N. Rao,** CAD/CAM Principles and Applications, Tata McGraw Hill Publishing Company Ltd.
7. **Mikell P. Groover and Emory W. Zimmers, Jr,** CAD/CAM Computer – Aided Design and Manufacturing**, PHI.**
8. **Mikell P. Groover**, Automation, Production Systems and CIM.
9. **David D. Bedworth, Mark R. Henderson and Philip M. Wolfe,** Computer Integrated Design and Manufacturing
10. **T.K. Kundra, P.N. Rao and N.K. Tewari,** Numerical Control andComputer Aided Manufacturing**,** Tata McGraw Hill Publishing CompanyLtd.
11. Paul G. Ranky, Computer Aided Manufacturing
12. **William M. Newmann and Robert F. Sproull**, Principle of Interactive Computer Graphics
13. **C.B. Besant and C.W.K. Lui,** CAD and Manufacture

Mapping of Course Outcomes with Program Outcomes:

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

MEP 08 CAD AND CAM LAB

Lectures/Week : 3periods

Credits: 2
Sessionals: 20 +20
End Examination Marks: 60

Course Objectives:

- To be able to understand and handle design problems in a systematic manner.
- To be able to apply CAD in real life applications.
- To be understand the basic principles of different types of analysis.

CAD Laboratory

The following drafting tools should learn by the student using any Drafting software and using these tools the student should be able to plot orthographic projections and 3D assembly drawing

Introduction to AUTOCAD-Co-ordinate system, Object snap, Draw Tools -Line, Polyline, Rectangle, circle, spline, Ellipse, Point, Hatch, Text, Modify Tools - Erase, copy, Mirror, Offset, Array, Move Rotate, Trim, Fillet, Dimensions - Dimension Variables, Linear, Aligned, Radius and diameter, Angular Dimensions

Exercise on the above commands limited to 2D plotting.

Using above drawing tools, drawing of machine components and Production drawing of mating components with limits and fits are given as exercises. Minimum of 5 components of detailed drawings should be drawn.

CAM Laboratory

Minimum of three exercises to be performed.

Part programming on turning and milling machines and execution on simulator.

Exercises on coordinate measuring machine CMM; Determination of dimensions of the given object; determination of angle between two surfaces;

Course Outcome:

CO1 Draw complex geometries of machine components in sketcher mode.

CO2 Create complex engineering assemblies using appropriate assembly constraints.

CO3 Develop G and M codes for turning and milling components.

CO4 Generate automated tool paths for a given engineering component.

CO5 Generate automated tool paths for a given engineering component.

Text Books:

1. . Bhatt N D and VM Panchal, Engineering Drawing Revised Edition, Chrotar Publications, 2010
2. Dhananjaya A Jolhe, Engineering Drawing with an introduction to AutoCAD, Tata Mc- Graw Hill – 2009.
3. Gautam Pohit, Gautam Gosh – Machine Drawing with Auto Cad- Pearson Publishers
4. Production drawing , K.L. Narayana, P. Kannaiah and K. Venkata Reddy, New age International Publishers.

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

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MEDE 04 MECHATRONICS

Lectures/Week : 4 periods

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

Course Objectives:

- Understand key elements of Mechatronics system, representation into block diagram and concept of transfer function, reduction and analysis.
- Understand principles of sensors, its characteristics, interfacing with DAQ microcontroller.
- Understand the concept of PLC system and its ladder programming, and significance of PLC systems in industrial application.
- Understand the system modeling and analysis in time domain and frequency domain.
- Understand control actions such as Proportional, derivative and integral and study its significance in industrial applications.

UNIT-I

Introduction: Introduction to Mechatronics, Scope of Mechatronics, Electronics for Mechanical Engineer, Mechanical systems for Electronic Engineer.

UNIT-II

Sensors: Introduction, Position and Speed measurement.

Actuators: Solenoids and relays, electric motors, D. C. Motors, Stepper motors, Selecting a Motor, Mechanical, Hydraulic and Pneumatic actuators, brief treatment.

UNIT-III

Brief Introduction to Control Systems: Control Systems, Example; open-loop, closed-loop control systems; Feed back characteristics of feed back; Fundamentals of Analog and Digital Control Systems, block diagrams; Fundamentals of block diagrams of continuous (Analog) feed back control systems. Terminology of the closed loop block diagram, block diagrams of discrete time (Sampled data digital) components. Control Systems and Computer Controlled Systems, Servo Mechanics.

UNIT-IV

PLC (Programmable Logic Controllers): Introduction, PLC programming, Mnemonics, Timers, Internal relay, counters, specifications and selection of PLC.

UNIT-V

Design of Mechatronics Systems: Introduction, automatic front and back end cutting in steel rolling mill, lift control system, CNC lathe, Temperature control of a heat treatment furnace, electrode arm control in electric arc furnace.

Course Outcomes:

CO1	Able to know the need and importance of Electronics for Mechanical Engineer and Mechanical systems for Electronic Engineer.
CO2	Able to classify various sensors, transducer and actuators according to the applications.
CO3	Ability to design basic control systems using different actuators.
CO4	Able to understanding of PLC programming and selection of appropriate PLC for industrial needs.
CO5	Acquire knowledge on various applications of design of mechatronic systems in real world problems.

TEXT BOOKS:

1. Doebelin E. O., Measurement System – Application and Design, Tata McGraw Hill Publications Ltd, New Delhi.
2. Bolton W. , Mechatronics – Electronics Control Systems in Mechanical and Electrical Engineering, Pearson – Education (Singapore) Pte. Ltd.
3. Rangan C. S., Sarma G. R., Mani V. S., Instrumentation – Devices and Systems, Tata McGraw Hill Publishing Company Ltd., New Delhi.
4. Histand B. H., Alciatore D. G., Introduction to Mechatronics and Measurement Systems.
5. Johnson C. D. ' Process Control Instrumentation Technology, Prentice Hall of India Pvt Ltd., New Delhi.
6. HMT, Mechatronics, HMT.
7. Mahalik N. P., Mechatronics – Principles, concepts and applications, Tata McGraw Hill Publishing Company Ltd, New Delhi.
8. Kolk R. A., Shetty D., Mechatronics Systems Design, Vikas Publishing Manual, Delhi.

Mapping of Course Outcomes with Program Outcomes:

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

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MEDE 05 ROBOTICS

Lectures/Week : 3 periods

Credits: 3
Sessional marks: 20 +20
End Examination Marks: 60

Course Objectives:

- To understand the basic concepts associated with the design and Functioning and applications of Robots.
- To develop the student's knowledge in various robot structures and their workspace and to study about the drives and sensors used in Robots
- To develop student's skills in perform kinematics analysis of robot systems and to learn about analyzing robot kinematics and robot programming
- To provide the student with some knowledge and analysis skills associated with trajectory planning.
- To provide the student with some knowledge and skills associated with robot control.

UNIT –I

Introduction – Basic components of a robotic systems- Classifications – SCARA – Robot motions – Specification characteristics of a robot- Spatial resolution, Accuracy, Repeatability, Work volume – Work volumes of different robot configurations.

UNIT-II

Robot Control System – Different types of controllers – On-Off, Proportional, Integral, Proportional and Derivative (PD), Proportional and Integral (PI) and PID Controllers – Analysis of robot joint axis – Open loop and closed loop control systems – Servo controlled and non-servo controlled robots. Drives – Hydraulic, Pneumatic and Electric drives – Robot joint control design.

UNIT-III

Trajectory Planning – cubic polynomials – Trajectory planning and robot controller. Robot sensors – types – Position, velocity, force, tactile, slip, range, proximity sensors and their applications. Vision sensors and Robot/Machine vision – elements of machine vision. Robot grippers – types of end-effectors/grippers – mechanical, vacuum and magenetic grippers – force analysis.

UNIT-IV

Kinematic Analysis of Robots – DH matrix – HT of robot coordinate system – 2R and 3R robot manipulators, Introduction to robot dynamics.

UNIT-V

Robot programming Methods – On – line and Off – line programming methods, Teach control box, Lead through programming Applications of robot – Material handling, Machine loading/unloading, Assembly, Inspection etc., Robot Work cells. Robot safety – Economic analysis.

Course Outcomes:

CO1	Able to demonstrate the basic functioning and identifying of various components of robots
CO2	Able to understand the different types of control systems, drive mechanisms and select appropriate drive system as per industry requirements and also apply various controls as per requirement.
CO3	Able to carry out kinematic analysis, workspace analysis and trajectory planning for a robot and also identify suitable sensors/actuators and grippers for robots
CO4	Able to select an appropriate robot for given industrial inspection and material handling systems.
CO5	Plan, design and implement robotic systems, algorithms and software capable of operating in complex and interactive environments.

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. Gonzalez K.S.F.U.R.C. and Lee C.S.G., "Robotics- Control, Sensing, Vision, and Intelligence" Mcgraw-Hill Book Company (July 1987)
4. 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

Mapping of Course Outcomes with Program Outcomes:

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

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

MEDE 06 NANOTECHNOLOGY

Lectures/Week : 3 periods

Credits: 3
Sessional marks: 20 +20
End Examination Marks: 60

Course Objectives:

- To provide knowledge about top-down and bottom-up approaches for the synthesis of nonmaterial's and to enhance the various nanosynthesis techniques and to identify and solve problems.
- To design and conduct experiments relevant to nanochemistry, as well as to analyze the results.
- To provide an overview of contemporary spectroscopy, microscopy, diffraction and analysis tools to characterize different properties of nonmaterials
- To develop ability to understand modern characterization techniques especially utilized to probe in nanoscopic regime
- To provide overview of principles underlying the characterization methods and basic theory for analysis of the data obtained from the instrument

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.

Course Outcome:

CO1	Integrate a deep and comprehensive understanding of nanoscale phenomena and material properties with core principles and concepts in chemistry, physics, engineering and mathematics.
CO2	Evaluate and analyze the mechanical properties of bulk nanostructured metals and alloys, nanocomposites and carbon nanotubes.
CO3	Exhibit integrated knowledge in the structure of matter at the nanoscale and the technological elements of the physical, chemical and bio-related properties of materials.
CO4	Able to discuss ethical issues relevant to nano biotechnology and nano medicine.
CO5	Build nonmaterial's using nanofabrication techniques, including top-down and bottom-up approaches.

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.

Mapping of Course Outcomes with Program Outcomes:

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