I-SEMESTER

S. No	Subject Code	Name of the Subject	Contact hours/ week		Credits	Scheme of Valuation		Total Marks
			L+T	P		Internal (CIE)	External (SEE)	
1	S239	English-I	4	--	3	25	75	100
2	S132	Applied Mathematics-I	4+1	--	3	25	75	100
3	S232	Engineering Chemistry	4	--	3	25	75	100
4	S170	Computer Programming	4+1	--	3	25	75	100
5	S235	Engineering Graphics	2	6	3	25	75	100
6	L144	English Communication Lab.	--	3	2	25	50	75
7	L126	Computer Programming Lab.	--	3	2	25	50	75
8	L140	Engineering Chemistry Lab.	--	3	2	25	50	75
9	L114	Basic Simulation Lab.	--	3	2	25	50	75
		TOTAL			**23**	**225**	**575**	**800**

II SEMESTER

S. No	Subject Code	Name of the Subject	Contact hours/ week		Credits	Scheme of Valuation		Total Marks
			L+T	P		Internal (CIE)	External (SEE)	
1	S240	English – II	4	--	3	25	75	100
2	S133	Applied Mathematics- II	4+1	--	3	25	75	100
3	S238	Engineering Physics	4+1	--	3	25	75	100
4	S147	Basic Mechanical Engineering	4+1	--	3	25	75	100
5	S237	Engineering Mechanics	4+1		3	25	75	100
6	L142	Engineering Physics Lab.	--	3	2	25	50	75
7	L124	Computer Aided Engineering Graphics Lab.	--	3	2	25	50	75
8	L143	Engineering Workshop.	--	3	2	25	50	75
9	L113	Basic Mechanical Engineering Lab.	-	3	2	25	50	75
		TOTAL			**23**	**225**	**575**	**800**

III-SEMESTER

S. No	Subject Code	Name of the Subject	Contact hours/ week		Credits	Scheme of Valuation		Total Marks
			L+T	P		Internal	External	
1	S134	Applied Mathematics- III	4+1	--	3	25	75	100
2	S408	Thermodynamics	4+1	--	3	25	75	100
3	S309	Metallurgy and Material Science	4+1	--	3	25	75	100
4	S305	Mechanics of Materials	4+1	--	3	25	75	100
5	S208	Electrical and Electronics Engineering	4+1	--	3	25	75	100
6	S293	Machine Drawing	-	6	3	25	75	100
7	**S243**	Environmental Studies	3			25	75	100
8	L159	Material Testing and MetallurgyLab	--	3	2	25	50	75
9	L133	Electrical and Electronics Engineering Lab	--	3	2	25	50	75
		TOTAL			**22**	**225**	**625**	**850**

Note : The Subject with Code S243 is Mandatory Course

IV SEMESTER

S. No	Subject Code	Name of the Subject	Contact hours/ week		Credits	Scheme of Valuation		Total Marks
			L+T	P		Internal	External	
1	S351	Probability and Statistics	4+1	--	3	25	75	100
2	S252	Fluid Mechanics and Hydraulic Machinery	4+1	--	3	25	75	100
3	S354	Production Technology	4+1	--	3	25	75	100
4	S286	Kinematics of Machines	4+1	--	3	25	75	100
5	S407	Thermal Engineering	4+1	--	3	25	75	100
6	S245	Estimation, Costing and Engineering Economics	4+1	--	3	25	75	100
7	**S355**	Professional Ethics and Human Values	3	--		25	75	100
8	L146	Fluid Mechanics and Hydraulic MachineryLab	--	3	2	25	50	75
9	L172	Production Technology and Modelling Lab	--	3	2	25	50	75
		TOTAL			**22**	**225**	**625**	**850**

Note: The Subject with Code S355 is Mandatory Course

V – SEMESTER

S. No	Subject Code	Name of the Subject	Contact hours/ week		Credits	Scheme of Valuation		Total Marks
			L+T	P		Internal	External	
1	S267	IC Engines and Gas Turbines	4+1	--	3	25	75	100
2	S291	Machine Design –I	4+1	--	3	25	75	100
3	S203	Dynamics of Machines	4+1	--	3	25	75	100
4	S270	Industrial Management	4	--	3	25	75	100
5	S308	Metal Cutting and Machine Tools	4	--	3	25	75	100
6	S329	Operations Research	4+1	-	3	25	75	100
7	L156	Machine Tools and Dynamics Lab	---	3	2	25	50	75
8	L181	Thermal Engineering lab	--	3	2	25	50	75
9	L176	Seminar		2	2	75		75
		TOTAL			**24**	**275**	**550**	**825**

VI – SEMESTER

S. No	Subject Code	Name of the Subject	Contact hours/ week		Credits	Scheme of Valuation		Total Marks
			L+T	P		Internal	External	
1	S259	Heat Transfer	4+1	--	3	25	75	100
2	S292	Machine Design –II	4+1	--	3	25	75	100
3	S317	Modern Machining Processes	4	--	3	25	75	100
4	S372	Robotics	4+1	--	3	25	75	100
5	**PROGRAM ELECTIVE - I**		4	--	3	25	75	100
	S302	Mechanical Vibrations						
	S285	Jet and Rocket Propulsion						
	S414	Tribology						
	S174	Control Systems						
6	**PROGRAM ELECTIVE – II**		4	--	3	25	75	100
	S402	Theory of Elasticity						
	S141	Automobile Engineering						
	S294	Machine Tool Design						
	S427	Work Study and Ergonomics						
7	L150	Heat Transfer Lab.	--	3	2	25	50	75
8	L119	Communication and Presentation Skills Lab.	--	3	2	25	50	75
9	L164	Mini Project	--	2	2	25	50	75
		TOTAL			**24**	**225**	**600**	**825**

VII – SEMESTER

S. No	Subject Code	Name of the Subject	Contact hours/ week		Credits	Scheme of Valuation		Total Marks
			L+T	P		Internal	External	
1	S250	Finite Element Method	4+1	--	3	25	75	100
2	S154	CAD/CAM	4	--	3	25	75	100
3	S367	Refrigeration and Air Conditioning	4+1	--	3	25	75	100
4	S310	Metrology and Instrumentation	4	--	3	25	75	100
5	**PROGRAM ELECTIVE – III**		4	--	3	25	75	100
	S303	Mechanics of Composites						
	S231	Energy Conservation and Management						
	S138	Automation in Manufacturing						
	S331	Optimization Methods and Applications						
6	**OPEN ELECTIVE – I**		4	--	3	25	75	100
	S319	Nano Technology						
	S311	Micro Electro Mechanical Systems						
	S370	Renewable Energy Sources						
	S357	Project Management						
7	L117	CAD/CAM Lab	--	3	2	25	50	75
8	L160	Metrology and Instrumentation Lab	--	3	2	25	50	75
9	L153	Internship	--	2	2	75		75
		TOTAL			**24**	**275**	**550**	**825**

VIII – SEMESTER

S. No	Subject Code	Name of the Subject	Contact hours/ week		Credits	Scheme of Valuation		Total Marks
			L+T	P		Internal	External	
1	S343	Power Plant Engineering	4	--	3	25	75	100
2		**PROGRAM ELECTIVE – IV**	4		3	25	75	100
	S109	Advanced Strength of Materials						
	S165	Computational Fluid Dynamics						
	S365	Rapid Prototyping						
	S353	Production Planning and Control						
3		**OPEN ELECTIVE – II**	4	--	3	25	75	100
	S158	Cognitive Engineering						
	S306	Mechatronics						
	S273	Innovation and Entrepreneurship						
	S409	Total Quality Management						
4	L121	Comprehensive Viva voce	-	3	2	75		75
5	L157	Main Project	-	8	9	50	150	200
		TOTAL			**20**	**200**	**375**	**575**

Note: A few courses as notified in the respective departments are offered to the students on electives under Massive Open Online Courses (MOOCs).

I SEMESTER

S239 - ENGLISH – I

(Common to all branches)

Prerequisite: None

Course Educational Objectives

In this course, the students will learn

1. The standard vocabulary along with the meaning and usage of the words
2. The concepts of functional grammar and syntax for better writing and speaking skills
3. The concepts of skimming, scanning and critical reading for better comprehension abilities.
4. The effective pronunciation, language usage through extensive reading
5. The concepts of writing reports, resume, statement of purpose, memos and e-mails etc.

Course Outcomes

After the completion of this course, students will have the ability to

1. Read, write and understand what ever is written and spoken in English
2. Speak fluently with acceptable pronunciation and write using appropriate words, spellings, grammar and syntax
3. Read the lines, between lines and beyond lines excelling in comprehension skills
4. Speak grammatically error free English
5. Draft reports, memos, mails & letters as part of their work.

UNIT – I

ASTRONOMY(Learning English)
Grammar: Parts of Speech
Vocabulary: Antonyms
Analytical Writing: Unscrambling words in a sentence; Un-jumbling the sentences into a paragraph; Types of sentences; Paragraph writing

UNIT – II

TRAVEL AND TRANSPORT(Learning English)
The Trailblazers - **Jagadis Chandra Bose**(Masterminds)
Grammar: prepositions; word plurals; sentence completion
Vocabulary: Synonyms
Analytical Writing: Drafting E-Mails; Letter writing (Formal & Informal)

UNIT - III

HUMOUR(Learning English)
The Trailblazers – **Prafulla Chandra Ray** (Masterminds)
Grammar: Active & Passive Voices
Vocabulary: Pre-fixes & Suffixes
Analytical Writing: Note-making

UNIT - IV

HEALTH AND MEDICINE (Learning English)
The Trailblazers – **SrinivasaRamanujam** (Masterminds)
Grammar: Tenses
Vocabulary: Deriving words
Analytical Writing: Abstract writing/Synopsis writing

UNIT - V

The World of Figures and Physics – **Chandra SekharaVenkataRaman** (Masterminds)
Grammar: Articles
Vocabulary: One-Word substitutes
Analytical Writing: Essay writing; Dialogue writing (Formal & Informal)

TEXT BOOKS

1 "Learning English", Orient Longman Private Limited. 2008 JNTU edition
2 EnakshiChatterjee, "Masterminds", Orient Longman Private Limited. 2002 (Reprint)

REFERENCES

1. Andrea J Rutherford, "Basic Communication Skills for Technology", Pearson Education, New Delhi,1st edition, 2009
2. Murphy, "English Grammar with CD", Cambridge University Press, New Delhi, 2004
3. Rizvi& M. Ashraf, " Effective Technical Communication", Tata McGraw Hill, New Delhi,2008.
4. Blum Rosen, "Word Power", Cambridge University Press, New Delhi, 2009.

I SEMESTER

S132 - APPLIED MATHEMATICS-I

(Common to AE, CE, CSE, EEE, EIE, IT, ME)

Prerequisite: None

Course Educational Objectives

In this course, the students will learn about

1. The concepts of Differential Equations and solving the first order and the first degree differential equations.
2. The concepts of Higher Order Differential Equations and solving such equations with constant and variable coefficients.
3. The concepts of theory of Matrices which are used to solve linear simultaneous equations.
4. The concept of Eigen Values and Eigen Vectors and solving an Eigen Value Problem.
5. The concepts of partial differentiation and formation of partial differential equations

Course Outcomes

After the completion of this course, students will able to :

1. Know fundamental mathematical skills required to form a necessary base to analyze first order differential equations.
2. Know the Higher Order Differential Equations, Procedures to solve them and their physical applications.
3. Find the solutions of System of Homogeneous and Non Homogeneous Linear equations using matrices for different physical applications.
4. Find Eigen values and Eigen vectors, higher powers and inverse of a given matrix, and can apply it in the concept of free vibrations of two- mass systems.
5. Find the solutions of linear partial differential equations.

UNIT – I

DIFFERENTIAL EQUATIONS OF FIRST ORDER AND FIRST DEGREE

Differential equations of first order and first degree – Exact, Linear and Bernoulli. Applications to Orthogonal trajectories, applications to LCR circuits.

UNIT – II

HIGHER ORDER DIFFERENTIAL EQUATIONS

Linear differential equations of second and higher order with constant coefficients and with variable coefficients, method of variation of parameters , Linear differential equations of second and higher order with variable coefficients – Cauchy's Equation and Legendre's Equations.

UNIT – III

FUNCTIONS OF SEVERAL VARIABLES

Generalized Mean Value Theorem(without proof), Maclaurin's series, Functions of several variables, Jacobians (polar, cylindrical, spherical coordinates), Functional dependence , , Maxima and Minima of functions of two variables with constraints and without constraints – Lagrangian Multiplier Method.Formation of Partial Differential Equations by the elimination of arbitrary constants and arbitrary functions. Solution of first order and first degree linear partial differential equation – Lagranze's method

UNIT –IV

SYSTEM OF LINEAR EQUATIONS.

Matrices - Rank- Echelon form, Normal form , PAQ form– Solution of Linear Systems – Homogeneous system of equations and Non Homogeneous System of Equations, Gauss Elimination, Gauss - Seidal and Jacobi Methods.

UNIT – V

EIGEN VALUES AND EIGEN VECTORS

Eigen values – Eigen Vectors – Properties – Cayley Hamilton Theorem – Inverse and Powers of a matrix by using Cayley Hamilton Theorem.

TEXT BOOKS

1. Dr. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition, 2012.
2. Dr. B. V. Ramana, "Higher Engineering Mathematics", Tata Mc.Graw Hill Publications,1stEdition,2010.

REFERENCES

1. M. D. Greenberg , "Advanced Engineering Mathematics",TMGHPublications,2ndEdition,2011.
2. Erwin Krezig, "Advanced Engineering Mathematics", John Wiley & Sons,8thEdition,2011.
3. W. E. Boyce and R. C. Diprima, " Elementary Differential equations", John Wiley &sons,7thEdition,2001.

I SEMESTER

S232 - ENGINEERING CHEMISTRY

(Common to all branches)

Prerequisite: None

Course Educational Objectives:

Through this course the student will learn

1. The concept of water technology with special focus on hardness & softness of water, methods of softening and desalination of brackish water.
2. The concept of conventional and alternative fuels and working of petrol and diesel engines.
3. The concept of corrosion and control measures.
4. The concept of polymers and polymerization.
5. The concept of green chemistry and applications of liquid crystals.

Course Outcomes:

After completion of the course the students will acquire the ability to:

1. Analyze the quality of water and its maintenance for industrial purposes.
2. Analyze issues related to fuels and their synthesis and able to understand working of IC and Diesel engines.
3. Realize the principles of corrosion and make use of the principles for maintenance of various equipments more effectively.
4. Get hands on experience in various processes like polymerization, preparation, properties and applications of plastics and rubbers.
5. Realize the use of liquid crystals in various technological applications.

UNIT - I

WATER TECHNOLOGY: Sources of water and quality. Hardness of Water - Temporary and Permanent hardness. Units and their interrelation. Problems on Temporary and Permanent hardness.Disadvantages of hard water in various industries.

BOILER TROUBLES– scale & sludge formation, Caustic Embrittlement, boiler corrosion, priming & foaming (carryover).

INTERNAL TREATMENT- Colloidal Phosphate, Calgon, Carbonate, Sodium aluminate Conditioning of Water.

EXTERNAL TREATMENT- Lime-Soda Process, Zeolite process , Ion- Exchange Process merits and demerits. (Note-Problems on lime-soda process are not included)

DESALINATION OF BRACKISH WATER-Electrodialysis, reverse osmosis

UNIT - II

FUEL TECHNOLOGY: Definition and classification of Fuels, merits and demerits of solid liquid and gaseous fuels.Gross and net calorific values – (definition only).

SOLID FUELS- coal - analysis, Proximate and ultimate analyses of coal – significances.

LIQUID FUELS– petroleum-origin and refining of petroleum- cracking- fixed bed and moving bed methods, synthetic petrol – Bergius and Fischer Tropsch's methods.

WORKING OF I.C AND C.I ENGINES–Knocking in I.C and C.I engines, antiknocking agents Octane number ,Cetane number(Definitions only)

GASEOUS FUELS- Natural gas, CNG Advantages of CNG, Flue gas analysis – Orsat's apparatus.

UNIT - III

CORROSION: Definition, Examples.

DRY CORROSION(Direct Chemical corrosion), Types of dry corrosion-oxidative corrosion, Pilling Bed worth rule, corrosion by other gases, liquid metal corrosion.

WET CORROSION(Electro Chemical corrosion) Mechanism- Oxygen absorption Hydrogen evolution type, Types of wet corrosion, Galvanic Corrosion, passivity, Galvanic Series Concentration Cell Corrosion, intergranular corrosion, stress corrosion, Soil corrosion.

FACTORS INFLUENCING CORROSION- Nature of metal and nature of environment.

CONTROL OF CORROSION- Proper Design, Use of pure metals and metal alloys, Cathodic Protection - Sacrificial anode and Impressed Current, Modifying the Environment and use of Inhibitors.

UNIT - IV

POLYMER SCIENCE AND TECHNOLOGY: Definition, classification of polymers, Functionality, Types of polymerization-addition, condensation, copolymerization

PLASTICSpreparation, properties and engineering applications of, PVC, Teflon, Bakelite ,PMMA.

CONDUCTING POLYMERS: Polyacetylene, Polyaniline, conduction, doping, application.

RUBBERSNatural rubber and it's processing, disadvantages of Natural rubber , Vulcanization and significance.

ELASTOMERS- preparation, properties and engineering applications of Buna S, Buna N, Thiokol.

FIBERS- preparation, properties and engineering applications of Polyester, fiber reinforced plastics (FRP).

UNIT – V

(a) **GREEN CHEMISTRY-**Goals and significance of green chemistry. Basic components (alternative starting materials, reagents, reaction conditions, final products) of green chemistry research.

(b) **LIQUID CRYSTALS –**Classification of liquid crystals (Thermo tropic, lyotropic) and applications.

TEXT BOOKS

1. Jain & Jain, A text book of Engineering Chemistry by DhanpatRai Publishing Company, New Delhi (15th Edition) (2006).
2. Dr. S.S Dara, Dr.S.SUmare A Text book of Engineering Chemistry by S.Chand Publications, 12th Edition, 2010.
3 . ShashiChawla, A Text book of Engineering Chemistry by DhanpatRai Publishing Company, Third Edition, 2003.

REFERENCES

1. Dr. Y. BharathiKumari and Dr. JyotsnaCherukuri, A Text book of Engineering Chemistry by VGSPublications, First Edition, 2009
2. R.V. Gadag, A.NityanandaShetty, I.K. International publishing house 1st edition 2006
3. Dr. M. R. Senapati, Advanced Engineering Chemistry by University Science Press (Impart from Laxmi Publications), 3rd Edition 2009.

I SEMESTER

S170 - COMPUTER PROGRAMMING

(Common to all branches)

Course Educational Objectives:

The Students will learn

1. The basic elements C programming structures like data types, expressions, control statements, various I/O functions and how to solve simple mathematical problems using control structures.
2. Modular programming using functions.
3. The derived data types like arrays, strings, various operations and Memory management using pointers.
4. User defined structures and various operations on it.
5. The basics of files and its i/o operations.

Course Outcomes:

After undergoing the training in this course the students will acquire the ability to:

- Identify basic elements of C programming structures like datatypes, expressions, control statements, various I/O functions and Evaluation of simple mathematical problems using control structures.
- Implementation of derived data types like arrays, strings and various operations.
- Understanding of memory management using pointers and designing of modular programming.
- Construct user defined structures and implements various applications.
- Create text & binary type files and understanding of various file I/O operations.

Pre Requisite: The students should have basic knowledge in Maths & computers

UNIT - I

Algorithm / pseudo code, flowchart, example flow charts, structure of C program, identifiers, basic data types and sizes, Constants, variables, Input-output statements, A sample c program, operators: arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operators, expressions, type conversions, conditional expressions, precedence of operators and order of evaluation. Conditional statements: if, ifelse, else if ladder and switch statements, continue, go to and labels. Loops: while, do-while and for statements, break, programming examples.

UNIT - II

ARRAYS- one dimensional arrays-concept, declaration, definition, accessing elements, storing elements, two dimensional and multi-dimensional arrays.**CHARACTER STRINGS:** declaration, initialization, reading, writing strings, arithmetic operations on characters, string handling functions programming examples

UNIT – III

POINTERS- concepts, declaring &initialization of pointer variables, pointer expressions, address arithmetic, pointers and arrays, pointers and character strings, pointers to pointers,Pre-processor Directives and macros. **FUNCTIONS:** basics, category of functions, parameter passing techniques, recursive functions, Functions with arrays, storage classes-extern, auto, and register, static, scope rules, Standard library functions., dynamic memory management functions, command line arguments, c program examples.

UNIT - IV

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, C program examples.

UNIT - V

FILES– concept of a file, text files and binary files, streams, standard I/O, Formatted I/O, file I/O operations, error handling, C program examples.

TEXT BOOKS

1. B.W. Kernighan, Dennis M.Ritchie ,"The C Programming Language, PHI/Pearson Education.
2. N.B.Venkateswarlu and E.V.Prasad "C and Data Structures" PHI/Pearson Education.

REFERENCES

1. Reema Thareja, Programming in C –Oxford Publications.
2. Stephen G. Kochan "Programming in C", 3rd Edition, Pearson Education
3. PradeepDey "Programming in C", Oxford Publications.

I SEMESTER

S235 - ENGINEERING GRAPHICS

(Common to AE, CE, ME)

Course Educational Objectives:

The main objectives of the course are

1. To understand the basics of engineering graphics and BIS conventions
2. To draw the various profiles/curves used in engineering practice
3. To understand the basics of orthographic projections in different axis.
4. To familiarize the basic concept of isometric views, lines and planes clearly.

Course Outcomes:

After completion of the course student will be able to:

1. Develop a simple engineering drawing in both First angle orthographic projections, BIS standards in engineering graphics.
2. Visualize the complex geometrical objects and the machine parts.
3. Visualize the solids clearly by sectioning
4. Conceptualize the ideas of isometric views and to make designs systematically.

UNIT - I

INTRODUCTION TO ENGINEERING DRAWING: Principles of Engineering Graphics and their significance - Drawing Instruments and their use-Conventions in Drawing-Lettering and Dimensioning – BIS conventions –Geometrical Constructions.

Curves:

a) Conic Sections- Ellipse, Parabola, Hyperbola and rectangular hyperbola- General method and other methods.
b) Cycloid, Epi-Cycloid and Hypo-Cycloid.
c) Involutes.

UNIT - II

ORTHOGRAPHIC PROJECTIONS:

Principle of orthographic projection-Method of Projection – First and third angle projection methods- Projections of Points –Projection of straight lines-True lengths and traces.

UNIT – III

PROJECTIONS OF PLANES: Planes parallel to one of the reference planes-Inclined to one reference plane and perpendicular to other-Oblique planes.

UNIT – IV

PROJECTIONS OF SOLIDS: Projection of solids in simple position - Axis inclined to one of the reference planes and parallel to the other-Axis inclined to both H.P and V.P.

UNIT - V

ISOMETRIC PROJECTIONS: Introduction-theory of isometric projection, isometric axes, scale, lines & planes-Isometric drawing of prisms, cylinders & cones-non isometric lines-conversion of isometric views to orthographic views and orthographic views to isometric views.

TEXT BOOK

N. D. Bhatt, Engineering Drawing, 51thRevised and Enlarged Edition, Charotar publishers, 2012

REFERENCES

1. Narayana K L, Kannaiah P, Textbook on Engineering Drawing, 2nd Edition, Scitechpublishers.
2. R.K.Dhawan, Engineering Drawing, S.Chand Company LTD.
3. Venugopal, Engineering Drawing and Graphics, New Age publishers
4. Dhananjay A. Jolhe, Engineering Drawing, Tata McGraw Hill Publishers

I SEMESTER

L144 - ENGLISH COMMUNICATION LAB

(Common to all branches)

Prerequisite: English-I

Course Educational Objectives

In this course, the students will learn to

1. Better pronunciation through emphasis on word accent.
2. Use language effectively to face interviews, group discussions and public Speaking
3. Possess Positive attitude and inculcate group behavior
4. Negotiate well with inter personal skills and intra personal skills
5. Speak spontaneously on any topic given

Course Outcomes

After the completion of this course, students will have the ability to

1. Withstand the global competition in the job market with proficiency in English communication.
2. Articulate English with good pronunciation.
3. Face competitive exams like GRE, TOEFL, IELTS etc.
4. Face interviews and skillfully manage themselves in group discussions
5. Communicate with the people effectively.

The following course content is prescribed for English Language Communication Skills Laboratory sessions:

1. Introduction to English Phonemes; Phonetic Transcription, Stress.
2. JAM
3. Role Play
4. Information Transfer
5. Group Discussions

SUGGESTED SOFTWARE

1. Digital Mentor: Globarena, Hyderabad, 2005
2. Sky Pronunciation Suite: Young India Films, Chennai, 2009
3. Mastering English in Vocabulary, Grammar, Spelling, Composition, Dorling Kindersley, USA, 2001
4. Dorling Kindersley Series of Grammar, Punctuation, Composition, USA, 2001
5. Oxford Talking Dictionary, The Learning Company, USA, 2002
6. Learning to Speak English - 4 CDs. The Learning Company, USA, 2002
7. Cambridge Advanced Learners English Dictionary (CD). Cambridge University Press, New Delhi, 2008

I SEMESTER

L126 - COMPUTER PROGRAMMING LAB

(Common to all branches)

Prerequisite Subject: COMPUTER PROGRAMMING

COURSE OBJECTIVES:

- To Learn the fundamentals of ANSI C programming and the standard C libraries
- To Get a solid understanding of C functions and data structures
- To Become familiar with the basic concepts of object-oriented programming
- To write programs using the C language.
- To Gain skills in C Programming Language.

COURSE OUTCOMES:

After completion of the course students..

- Can write programs in C language.
- Can use loops effectively in programming.
- Can use files concept in programming.
- Can gain skills in C programming

LIST OF LAB PROGRAMS:

I) Write a programme in 'C' language to cover the following problems.

a) Example program which shows the usage of various preliminary Data types available in C Language.

b) Example program which shows the usage of various Operators available in C Language.

c) Example programs to illustrate the *order of evaluation*.

II) WRITE EXAMPLE PROGRAMS:

a) To check whether the given year is leap year (or) not

b) Roots of Quadratic Equation.

c) Finding smallest& biggest number from the given set of 4 numbers using 'if' statement.

d) Calculate the student grade in the examination – assume suitable constraints.

e) Prepare electricity bill for the consumed units – assume suitable Constraints.

f) Converting given two digit number into words using switch statement

g) To illustrate the usage of 'goto' statement.

III) EXAMPLE PROGRAMS:

a) To Display first N natural numbers

b) To find whether the given number is Armstrong (or) not

c) To find reverse of the given number and to check whether it is palindrome (or) not.

d) To find whether given number is strong number (or) not.

e) To check whether given number is Prime (or) not

f) To display prime numbers with in the given range(Nesting of Loops).

g) To display the following structure(Nesting of Loops)

i)

```
1
1 2
1 2 3
1 2 3 4
1 2 3 4 5
```

ii)

```
5 4 3 2
4 3 2 1
3 2 1
2 1
1
```

IV) Write example programs in C Language to perform following operations:

a) Finding the sum and average of given numbers using Arrays.

b) To display elements of array in reverse order

c) To search whether the given element is in the array (or) not using linear search & binary search.

d) Write a C program to perform the following operations

i) Addition, subtraction and multiplication of Matrices

ii) Transpose of given matrix

(The above operations are to be exercised using functions also by passing arguments)

e) Write a C program to find whether the given string is palindrome (or) not.

f) To accept line of text and find the number of characters, number of vowels and number of blank spaces in it.

g) Write an example program to illustrate the use of any 5 string handling functions.

V) a) Example program to bring clarity on pointer declaration & initialization and Pointer arithmetic.

b) Write an example program to describe the usage of *call by reference*.

c) Write a program to find sum of the elements of the array using

functions.

VI) Write example programs in C Language:
a) To find factorial of a given number using functions.
b) Swap two numbers using functions.
c) To find GCD of two numbers using recursion
d) Write a recursive function to solve Towers of Honai problem.
e) Write an example program to illustrate use of external & static storage classes.

f) Write an example program to illustrate the usage of command line arguments.
g) Program to illustrate the usage of dynamic memory management functions.

VII) a) Write an example program using structures to process the student record. Assume suitable fields for student structures (Different kinds of initialization of structure variables are to be exercised)
b) Write a program to read records of 10 employees and find their average salary (exercise array of structures & Nested structures concepts through this program).
c) Write a program to handle a structure variable using pointers and implement selfreferential structure(i.e. A structure variable having a pointer to itself)

VIII) Write an example program on file to perform following operations:
a) Accessing content from files and writing content in to it.
(Exercise different file operation modes)
b) Copy the contents of one file into another (Exercise different file operation modes)

I SEMESTER

L140 - ENGINEERINIG CHEMISTRY LAB

(Common to all branches)

Prerequisite: None

Course Educational Objectives:

Through this course the student will learn

1. To analyze water for its quality and to determine the important parameters like alkalinity and hardness.
2. To distinguish types of titrations used in volumetric analysis.
3. To gain hands on experience in practical aspects of preparation of polymers.

Course Outcomes:

After undergoing the training in this course the students will acquire the ability to:

1. Assess quality of water based on the procedures given.
2. Distinguish different types of titrations in volumetric analysis after performing the experiments listed in the syllabus**.**
3. Acquire practical knowledge related to preparation of polymers.
4. Exhibit skills in performing experiments based on theoretical fundamentals.

MODEL EXPERIMENT

1. Estimation of sodium hydroxide by using hydrochloric acid.

WATER ANALYSIS

2. Determination of alkalinity of water sample
3. Determination of total Hardness of water by EDTA method
4. Determination of permanent hardness of water by EDTA method.
5. Determination of Dissolved Oxygen (D.O) content by Winkler's method

PREPARATION OF POLYMERS

6. Preparation of Urea formaldehyde resin.
7. Preparation of Phenol formaldehyde resin.

REDOX TITRATIONS

8. Determination of amount of potassium dichromate in given solution by using sodium thiosulphate.
9. Determination of the amount of Oxalic acid and Sulphuric acid in 1 liter solution by Using given standard Sodium Hydroxide and Potassium Permanganate solution.
10. Estimation of Mohr's salt by using potassium permanganate.
11. Estimation of Mohr's salt by using potassium dichromate.
12. Estimation of Mohr's salt by using Oxalic acid.

ESTIMATION OF VITAMIN CONTENT

13. Estimation of Vitamin-C

REFERENCES

Lab manual

I SEMESTER

L114 - BASIC SIMULATION LAB

(Common to AE, EEE, ME)

Any 10 experiments are to be conducted

Course Educational Objectives:

This lab gives the students

1. Overview to Lab VIEW and NI Software
2. A good background in what the Lab VIEW interface looks like.
3. Shows how to navigate the graphical programming language environment.
4. Introduces some of its analysis capabilities

Outcomes

After completion of the course student will be able to:

1. Understand the different parts of a Lab VIEW program
2. Learn simple debugging techniques
3. Learn how to make decisions in Lab VIEW
4. Learn how to create an executable file with Lab VIEW

LIST OF LAB PROGRAMS:

1. Perform basic arithmetic operations using Labview.
2. Debugging a VI.
3. Converting a VI into a Sub VI
4. Creating an executable file from VI.
5. Performing Boolean operations using Labview.
6. Finding the sum of 'n' numbers using FOR loop.
7. Performing the factorial of a given number using FOR loop.
8. Finding the sum of n natural numbers using while loop.
9. Performing the factorial of a given number using WHILE loop.
10. Sorting even numbers using WHILE loop in an array.
11. Searching and replacing a string.
12. Finding the maximum and minimum variable from an array.

REFERENCES :

Lab Manual

II SEMESTER

S240 - ENGLISH – II

(Common to all branches)

Prerequisite: ENGLISH-I

Course Educational Objectives

In this course, the students will learn

1. English with emphasis on LSRW skills.
2. To make decisions, while thinking logically analyzing situations carefully.
3. To read speedily and meaningfully.
4. Both active and passive vocabulary.
5. To write letters and reports effectively in formal and professional situations.

Course Outcomes

After the completion of this course, prospective engineers will have the ability to

1. Use English language effectively.
2. Express right ideas in right context
3. Manage the situation and negotiate business with good English communication
4. Think and analyze the situations and make good presentations of their work and decisions
5. prepare themselves to face interviews and also to participate in group discussions

UNIT - I

ENVIRONMENT(Learning English)
The World of Figures and Physics – **Satyendranath Bose** (Master Minds)
Grammar: Correction of sentences
Analytical Writing: Report Writing

UNIT - II

INSPIRATION(Learning English)
The Institution Builders– **SantiSwarupBhatnagar** (Masterminds)
Grammar: If-clause; Question tags
Vocabulary: Idioms and Phrases
Analytical Writing: Resume'; Statement of Purpose

UNIT - III

HUMAN INTEREST(Learning English)
The institution builders – **MeghanadhSaha** (Master Minds)
Grammar: Direct & Indirect Speeches
Vocabulary: Phrasal Verbs
Analytical Writing: Memo Drafting

UNIT – IV

MEDIA(Learning English)
The New Age – **HomiJehangirBhabha** (Master Minds)
Grammar: Concord
Vocabulary: Analogy
Analytical Writing: Information Transfer/ Data Interpretation (Tables, Pie charts, Bar graphs, Tree diagrams, Pictograms, etc.)

UNIT – V

The New Age – **Vikram Sarabhai** (Master Minds)
Grammar: Gerunds & Infinitives; Correction of Sentences
Vocabulary: Words often confused
Analytical writing – Comprehension, Expansions (of a given topic/ proverbs)

TEXT BOOKS

1. "Learning English", Orient Longman Private Limited.JNTU edition,2008
2. EnakshiChatterjee, "Masterminds", Orient Longman Private Limited ,Reprint-2002

REFERENCES

1. KoneruAruna, "Professional Communication", Tata McGraw-Hill, New Delhi, 2007.
2. Rizvi, "Effective Technical Communication", Tata McGraw-Hills, New Delhi, 2009.
3. Andrea J. Rutherford, "Basic Communication Skills for Technology", Pearson Education., 1st edition, 2009
4. Kaplan and Baron's, "GRE and TOEFL', Latest editions.2008

II SEMESTER

S133 - APPLIED MATHEMATICS – II

(Common to AE, CE, CSE, EEE, EIE, IT, ME)

Prerequisite: None

Course Educational Objectives:

In this course student will learn about

1. The basic concepts of Laplace Transforms and their applications in solving the Differential Equations.
2. The expansion of function in an infinite series of sine and cosines.
3. Fourier Integral Theorem, Fourier Integral Transforms along with their properties and applications.
4. Z-transform and its role in discrete analysis and in solving Difference equations.
5. The concepts of multiple integrals and changing of order of integration

Course outcomes:

At the end of this course student will be able to

1. Understand the importance of mathematics and its techniques to solve real life problems.
2. Apply the concepts of Laplace Transforms on Operational Calculus and solve Differential Equations of any order.
3. Express most of the single valued functions in the form of Fourier series and extend the ideas and techniques to non-periodic functions also.
4. Express a function as a continuous frequency resolution using Fourier Transforms.
5. Understand the analogy between Laplace Transform and Z-Transform and apply it wherever necessary & apply Multiple Integrals in various coordinate systems.

UNIT – I

LAPLACE TRANSFORMS

Laplace transforms of standard functions –Shifting Theorems, Transforms of derivatives and integrals – Unit step function –Dirac's delta function. Inverse Laplace transforms– Convolution theorem - Applications of Laplace transforms to ordinary differential equations.

UNIT – II

FOURIER SERIES

Determination of Fourier coefficients – Fourier series – even and odd functions – Fourier series in an arbitrary interval– Half-range sine and cosine series

UNIT – III

FOURIER TRANSFORMS

Fourier integral theorem (only statement) – Fourier sine and cosine integrals – Fouriertransform – sine and cosine transforms – properties – inverse transforms – Finite Fourier transforms.

UNIT – IV

Z-TRANSFORMS

Z-transform – properties – Damping rule – Shifting rule – Initial and final value theorems - Inverse Z –transform - Convolution theorem – Solution of difference equation by z-transforms.

UNIT – V

MULTIPLE INTEGRALS

Multiple integrals - double and triple integrals (Cartesian, polar, spherical coordinates) – Changing of order of Integration and applications to areas and volumes.

TEXT BOOKS

1. Dr. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers,42nd Edition,2012.
2. Dr. B. V. Ramana, "Higher Engineering Mathematics", The McGraw Hill Companies,1st Edition,2010.

REFERNCES

1. Michael D. Greenberg , "Advanced Engineering Mathematics",The McGraw Hill Companies, 2nd Edition,2011.
2. Erwin Krezig, "Advanced Engineering Mathematics", John Wiley & sons,8th Edition,2011.

II SEMESTER

S238 - ENGINEERING PHYSICS

(Common to all branches)

Pre-requisite course: NONE

Course Educational Objectives:

In this course student will learn about

- The basic concepts of Optics such as Interference, Diffraction and Polarization.
- The principle of quantum mechanics,dual nature of matter waves.
- The principle and working of different Lasers.
- The principle and classification of optical fibers
- classification of magnetic materials and their properties.
- Concept of Superconductivity, types and their applications

Course Outcomes:

At the end of this course student will be able to

CO1: Understand the nature of polarization, Diffraction and interference.

CO2: Understand the dual nature of particle and significance of the wave function .

CO3: Understand the principle of LASER and optical fibers. Types of lasers and optical fibers and their applications.

CO4: Understand the different types of magnetic materials and their uses.

CO5: Understand the phenomenon of superconductivity, critical parameters, types of super conductors and their applications

UNIT – I

INTERFERENCE, DIFFRACTION, POLARIZATION

INTERFERENCE: Introduction, super position principle, coherent sources, thin films, Newton's rings (in reflected system only).

DIFFRACTION:

Introduction, Fresnel and Fraunhofer diffractions – comparsion between Fresnel's and fraunhofer's diffraction-Difference between interference and diffraction-Fraunhofer diffraction at single slit - Fraunhofer diffraction at Double slit –Diffraction Grating- Grating spectrum.

POLARIZATION:

Introduction-plane of vibration and plane of polarization -Polarization by reflection Brewster's law –geometry of calcite crystal- Double refraction -nicol prism construction ,Quarter wave plate- Half wave plate.

UNIT - II

PRINCIPLES OF QUANTUM MECHANICS:

De Broglie hypothesis- Matter waves- Davison and Germer experiment- GP Thomson experiment , Heisenberg Uncertainty principle-Schrodinger time independent wave equation-Physical significance of the wave function-particle in a box.

UNIT – III

LASERS AND FIBER OPTICS

LASERS:

Introduction – Characteristics of Lasers- Principle of laser (Absorption, Spontaneous and stimulated emission of Radiation), Population Inversion- Einstein Coefficients ,three and four level pumping schemes, block diagram of laser. Ruby Laser- Helium Neon Laser, Applications of Lasers.

FIBER OPTICS

Introduction- Principle of optical Fiber- Acceptance angle and Acceptance cone- Numerical aperture – Types of optical fibers-refractive index profile- Application of optical fibers.

UNIT – IV

MAGNETIC MATERIALS:

Magnetic properties -Origin of magnetic moments-Classification of magnetic materials- Dia, Para, Ferro magnetic , Antiferromagnetic , Ferrimagnetic materials- Domain theory of ferromagnetism(qualitative), Hysteresis curve- Soft and Hard magnetic materials. Applications of magnetic materials.

UNIT – V

SUPER CONDUCTORS

Phenomenon, critical parameters, Meissner effect, Type-I, Type-II Super conductors, BCS theory of super conductivity,FluxQuantization,LondonEqs., Penetration depth, Josephson Effects- Applications of Super conductors.

TEXT BOOKS

1. Engineering Physics by V RAJENDRAN Tata Mc. Graw Hill
2. Engineering Physics by P K PalaniSamy, Scitech Publications

REFERENCES

1. M R Srinivasan , Engineering Physics, New age international,2014.
2. M.N.Avadhanulu and P.G.Kshirsagar, S.Chand , Engineering physics, New Delhi.
3. RK GAUR & SL GUPTA, Engineering Physics, DhanpatRai Publication, 2008.
4. Dr. P. SrinivasaRao& Dr. K. Muralidhar, Basic Engineering Physics ,Himalaya Publishing House.

II SEMESTER

S147 - BASIC MECHANICAL ENGINEERING

Prerequisite Subject: No prerequisite subject is required

Course Objectives:

The main objectives of this course are

1. To learn various manufacturing processes.
2. To understand basic concepts of centroid, center of gravity and moment of inertia.
3. To understand the basic concepts and laws of thermodynamics.
4. To learn types of fuels and lubricants.
5. To understand the working of IC engines, steam turbines and gas turbines.

Course Outcomes:

After completion of the course student will be able to:

1. Apply the knowledge of metal joining processes and to make simple product.
2. Locate centroid, center of gravity and moment of inertia of plane figures and bodies.
3. Analyze the concepts of Energy transformation, energy degradation.
4. Analyze the various fuels for combustion.
5. Analyze the concepts of IC engines, steam power plant and gas power plant.

UNIT-I

MANUFACTURING PROCESS: Introduction to manufacturing –Types of Manufacturing Processes
CASTING –Introduction, Green Sand Moulding, Patterns –Types of patterns
WELDING – Introduction, Types of welding processes-Principle of Arc Welding and Resistance Welding
MACHINE TOOLS: Introduction –Operations of Lathe Machine - Operations of Milling -Operations ofDrilling – Applications of machine tools.

UNIT-II

CENTROID AND CENTRE OF GRAVITY: Concept of Centroid and Centre of gravity, Centroid of simple figures from basic principles, Centre of gravity of simple bodies.
AREA MOMENT OF INERTIA: Theorems of Moment of Inertia – Determination of Moment of Inertia of Circle, Rectangle, Hollow Circle, Semi Circle, Triangle from basic principles.
MASS MOMENT OF INERTIA: Radius of gyration - Determination of Mass Moment of Inertia of Uniform Rod, Rectangular Plate, Circular Plate, Solid Cone, Solid Sphere, Solid Cylinder.

UNIT-III

BASIC CONCEPTS OF THERMODYNAMICS: Introduction, System, Property, State, Path, Process, Cycle, Zeroth law of thermodynamics, Energy,Internal Energy, Enthalpy, Specific heat, Latent heat - First law of thermodynamics, Heat Engines ,Refrigerator ,Heat Pump- Second law of thermodynamics (Theory questions).
SOURCES OF ENERGY: Introduction, classification of renewable and non renewable energy sources-Simple solar energy power plant working principle- Simple wind energy power plant working principle.

UNIT-IV

FUELS: Definition, classification of fuels, merits and demerits of solid, liquid and gaseous fuels, gross and net calorific values - (Definitions only)
LUBRICANTS: Definition of lubricants, function of lubricants, types of lubricants, properties of lubricants – viscosity, flash and fire point, cloud and pour point, aniline point of neutralization number, selection of lubricants.

UNIT - V

HEAT ENGINES: Introduction to heat engines –Types of Heat Engines

I.C. ENGINES: Introduction, classification, I.C engine parts and their functions, I.C engine Nomenclature, working of 4-stroke petrol & diesel engines, working of 2-stroke petrol &diesel engines and comparison –Valve and Port timing diagrams- Applications of IC engines.

STEAM TURBINES: Introduction, Classification of impulse and reaction turbines, comparison of impulse and reaction turbines and applications.

GAS TURBINES: Introduction, classification, constant pressure open cycle, constant pressure closed cycle gas turbines, difference between open and closed cycle gas turbines and applications (Theory questions only).

TEXT BOOKS

1. S.Tryambakamurthy,"Elements of mechanical Engineering",I.K International publishers,3rd edition-2006
2. Jain &Jain,"A Text Book of Engineering Chemistry, "DhanpathRai Publishing company,New Delhi,15thedition 2012.
3. S.S. Bhavikatti, Engineering Mechanics, , 4thEdition,New Age International (P) Ltd, 2012.
4. N.H.Dubey, Engineering Mechanics, McGraw Hill, 2013.

REFERANCES

1. M.M.Rathore,"Elements of Mechanical Engineering", DhanpathRai Publishing company, 3rd edition 2006.
2. N.H.Dubey, Engineering Mechanics, McGraw Hill, 2013.

II SEMESTER

S237 - ENGINEERING MECHANICS

Course Educational Objectives: The main objectives are to enable the students

1. To draw the free-body diagrams and to find the resultants & moments of system of forces and calculate reactions/contact forces to ensure equilibrium of bodies in contact.
2. To understand the mechanics problems associated with friction forces
3. To understand the motion of particles in terms of its position, velocity and acceleration & form the corresponding relations
4. To understand the concept of the projectile motion and motion of connected bodies
5. To understand the effect of gravitational and inertia forces on the moving bodies

Course Outcomes:

After completion of the course student will be able to:

1. Apply the principles of free body diagrams & equilibrium conditions in industries while designing any component
2. Solve the static equilibrium of rigid bodies
3. Estimate the trajectory and range of missiles in defense
4. Estimate the displacement, velocity and accelerations of moving bodies.
5. Analyze the work energy method and apply these methods to practical problems

UNIT – I

INTRODUCTION TO ENGINEERING MECHANICS – Basic Concepts of mechanics

RESULTANT OF SYSTEM OF FORCES: Resultant of Coplanar Concurrent Force System - Resultant of Coplanar Non-Concurrent Force System – Moment of a Force – Couple – Varignon's Theorem - Resultant of Force Systems

EQUILIBRIUM OF SYSTEM OF FORCES: Equilibrium of a Body Subjected to Concurrent Forces - Free Body Diagrams - Lami's Theorem - Equilibrium of Connected Bodies

UNIT - II

FRICTION: Introduction - Types of Friction - Laws of Friction - Angle of Friction - Angle of Repose –Problems on blocks resting on horizontal and inclined planes -Ladder friction

UNIT - III

KINEMATICS: Rectilinear Motion – Motion Curves – Motion with Uniform Velocity – Motion with Uniform Acceleration

PROJECTILES: Definitions – Motion of a Body Projected Horizontally – Inclined projection on Level Ground – Inclined Projection with Point of Projection and Point of Strike at Different Levels

UNIT – IV

KINETICS: Bodies in Rectilinear Translation - Bodies in Curvilinear Translation - Kinetics of Bodies Rotating about Fixed Axis- Kinetics of Rolling Bodies.

UNIT – V

WORK ENERGY METHOD: Equation for Translation – Motion of Connected Bodies – Kinetic Energy of Bodies in Fixed Axis Rotation

TEXT BOOKS

1. S.S. Bhavikatti, Engineering Mechanics, , 4th edition, New Age International (P) Ltd, 2012.
2. N.H.Dubey, Engineering Mechanics, McGraw Hill, 2013.

REFERENCES

1 Fedinand . L. Singer, Engineering Mechanics, 3rd edition, Harper – Collins, 1994
2. B.Bhattacharya, Engineering Mechanics,1st edition , Oxford University Press,2008
2. A.K.Tayal, Engineering Mechanics,14th edition , 2nd reprint, UmeshPublications,2012.
3. R.K.Bansal,Engineering Mechanics, 3rdedition,Laxmi Publications, 1996.
4. Manoj K Harbola, Engineering Mechanics,2nd edition, Cengage Learning,2012.

II SEMESTER

L142 - ENGINEERING PHYSICS LAB

(Common to all branches)

Pre-requisite course: NONE

Course Educational Objectives:

In this course student will learn about

- The scientific method of experiments in the laboratory.
- The procedures and observational skills for appropriate use of simple and complex apparatus.
- Analytical techniques, statistical analysis and graphical analysis.
- The theoretical ideas and concepts covered in lecture by completing a host of experiments.
- The radius of curvature of a Plano-convex lens by forming Newton's rings.

Course Outcomes:

At the end of this course, student will be able to

CO1: Understand to calculate the radius of curvature of a plano-convex lens by forming Newton's Rings.

CO2: Understand the concept of diffraction and also find wavelengths of different spectral lines of the grating.

CO3: Estimate the wavelength of layer radiation.

CO4 : Study the magnetic field along the axis of a current carrying coil and to verify Biot –savart's law .

CO5 : Estimate the Refractions index of the given prism

CO6 : Find the thickness of a thin material using a wedge shaped film.

CO7 : Estimate the width of the slit by forming diffraction pattern.

CO8 : Understand the phenomenon of optical – activity

CO9 : Study the characteristics of LCR circuit

CO10: Understand the Phenomenon of resonance

CO11: Determine the rigidity modules of given material

CO12 : Understand the longitudinal and transverse vibrations of tuning fork.

LIST OF EXPERIMENTS: (Any 8 Experiments)

1. Determine the Radius of Curvature of Plano - Convex lens by forming Newton's Rings.
2. Determine the Wavelengths of various spectral lines using grating with the normal incidence method.
3. Determination of wavelength of laser radiation.
4. Study the magnetic field along the axis of a current carrying coil and to verify Biot –Savart's law.
5. Determine the Refractive index of a given prism.
6. Determine the thickness of a thin material using wedge shaped film.
7. Determine the width of the slit by using laser source by forming diffraction pattern.
8. Determine the specific rotation of an optically active substance.
9. Study the characteristics of L.C.R Circuit.
10. Determine the frequency of AC supply by using Sonometer.
11. Determine the rigidity modulus of a given material using Torsional pendulum.
12. Determine the frequency of a vibrating bar or electrical tuning fork using Meldy's apparatus.

Reference Books:

Lab Manual prepared by the LBRCE.

II SEMESTER

L124 - COMPUTER AIDED ENGINEERING GRAPHICS LAB

(Common to AE, CE, ME)

Course Educational Objectives:

The main objectives of this course are

1. To learn the basic commands necessary for professional 2D drawings, design, and drafting using AutoCAD essentials.
2. To develop orthographic projections and isometric drawings using Auto-CAD.
3. To draw the solids by developing the surfaces without any complexity.

Course Outcomes:

After completion of the course students are the able to:

1. Understand the Auto-CAD basics and apply to solve practical problems used in industries where the speed and accuracy can be achieved.
2. Apply this idea and make design and modifications as required.
3. Draw 2-dimensional drawings of conventional engineering objects using Auto-CAD

At least 10 Exercises are to be conducted using Auto Cad software:

BASIC AUTO CAD COMMANDS:

1. Basic drawing commands (line, circle, arc, ellipse, polygon, and rectangle).
2. Edit commands (copy, move, erase, zoom).
3. Array commands (polar array, rectangular array, P-edit, divide aline, offset).
4. Hatching &line commands (hatching with different angles& different types of lines).
5. Mirror & trim commands (mirror an object, trim, extend a line, chamfer &fillet, explode).
6. Dimensioning & text commands (linear, angular, radius, diameter& text).

PROJECTION OF POINTS AND LINES:

1. Projection of points (I, II, III, & IV quadrants).
2. Projection of lines parallel to both reference planes.
3. Projection of lines parallel to one reference plane & inclined to other reference plane.

PROJECTION OF PLANES AND SOLIDS:

1. Projection of planes parallel to one reference plane & perpendicular to other reference plane.
2. Projection of planes inclined to one reference plane& perpendicular to other reference plane.
3. Projection of solids in simple position.
4. Projection of solids with axes inclined to one reference plane & parallel to other.

ORTHOGRAPHIC PROJECTIONS:

5. Conversion of plane figures.
6. Conversion of circular figures.
7. Conversion of both combination of plane figures and circular figures.

ISOMETRIC PROJECTIONS:

8. Conversion of plane figures.
9. Conversion of circular figures.
10. Conversion of both combination of plane figures and circular figures.

REFERENCES:

1. M. Kulkarni, A.P Rastogi, and A.K. Sarkar, Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi, 2009.
2. Bethune, Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi, 2009.
3. N. D. Bhatt, Engineering Drawing, 51th Revised and Enlarged Edition, Charotar Publishers, 2012.

CYCLE: 1

SNO	SHEETS	EXERCISE	COMMANDS TO BE COVERED	REFERENCES	PAGE NUMBER
1	SHEET-1	Basic drawing commands	line, circle, arc, ellipse, polygon, and rectangle	PLATE 2.1& 2.2	26
2	SHEET-2	Edit commands	copy, move, erase, zoom, measure, divide, pan, change properties	PLATE 2.3& 2.4	27
3	SHEET-3	Array commands	polar array, rectangular array, P-edit, divide aline, offset	PLATE 2.5& 2.6	28&29
4	SHEET-4	Hatching &line commands	hatching with different angles& different types of lines	PLATE 2.8& 2.9	31&32
5	SHEET-5	Mirror & trim commands	mirror an object, trim, extend a line, chamfer &fillet, explode	PLATE 2.7& 2.13	30&35
6	SHEET-6	Dimensioning & text commands	linear, angular, radius, diameter& text	PLATE 4.1	69
7	SHEET-7	Projection of points	Points & lines	Case-1,2,3,4	171
8	SHEET-8	Projection of lines(parallel to both reference planes)	Line	Fig:9.4(a & b)	172&173
9	SHEET-9	Projection of lines (parallel to one reference plane & inclined to other reference plane)	Lines	Fig:9.4(c)	173
10	SHEET-10	Projection of planes(inclined to one plane)	Polygons	EX:10.2&10.3	198&199
11	SHEET-11	Projection of solids	Line, polygon, rectangle	EX:12.42&12.44	234&235

CYCLE: 2

SNO	SHEETS	EXERCISES	REFERENCE	PAGE NUMBER
Orthographicprojections				
	SHEET-12	Conversion of plane figures	PLATE 5.1& 5.3	82&83
13	SHEET-13	Conversion of circular figures	PLATE 5.9& 5.13	86&88
14	SHEET-14	Conversion of both combination of plane figures and circular figures	PLATE 5.25,5.26 PLATE5.27,5.28	94&95
Isometric projections				
15	SHEET-15	Conversion of plane figures	PLATE 6.3	122
16	SHEET-16	Conversion of circular figures	PLATE 6.4	123
17	SHEET-17	Conversion of both combination of plane figures and circular figures	PLATE 6.8&6.10	125&126

Note: References and Page numbers have been given from below text books

M. Kulkarni, A.P Rastogi, and A.K. Sarkar, Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi, 2009.

II SEMESTER

L143 - ENGINEERING WORKSHOP

(Common to EIE, AE, CE, ECE, EEE, ME)

Course Educational Objectives:

The objectives of the course are:

1. To get familiarize with various trades used in Engineering workshop.
2. The understand the concept of various tools used in different trades.
3. To learn the safety pre-cautions to be followed in the workshops, while working with the different tools.

Course outcomes:

After completion of the course students are able to :

1. Acquire manufacturing skills.

Use the tools effectively in making a product.
At least **four trades** with **two exercises** from each trade:

1. Carpentry
2. Fitting
3. House – Wiring
4. Plumbing
5 Tin - Smithy
6. Black - Smithy

REFERENCE

1. P. Kannaiah, K.L. Narayana, Workshop manual, Scitech Publications, India Pvt Ltd

II SEMESTER

L113 - BASIC MECHANICAL ENGINEERING LAB

Course objectives:

The main objectives of this course are

1. To learn different types of Viscometers.
2. To learn the concept of Radius of Gyration
3. To understand valve timing and port timing diagrams in I.C engines.
4. To learn different welding techniques.
5. To study different types of machine tools.

Course outcomes:

After completion of course students are able to:

1. Find the Viscosity of different oils using Viscometers.
2. Find the Radius of Gyration using compound pendulum and Bifilar suspension.
3. Analyze valve and port timing diagrams in I.C engines.
4. Prepare the Butt joint by Arc welding.
5. Develop the skills to work on different machine tools.

List of Experiments

At least 10 experiments areto be conducted:

1. Verification of theoretical and experimental periodic times using simple pendulum
2. Determination of Radius of Gyration using compound pendulum.
3. Determination of Radius of Gyration using Bifilar suspension.
4. Determination of viscosity of given oil using Redwood viscometer
5. Determination of viscosity of given oil using Engler's Viscometer.
6. Valve timing diagram for single cylinder, four stroke water cooled Diesel engine.
7. Port timing diagram for single cylinder, two stroke air cooled Diesel engine.
8. Determination of Flash and Fire points of a given oil using ABEL'S apparatus.
9. Preparation of Rectangular tray using sheet metal.
10. Preparation of cone using sheet metal.
11. Single V-Butt joint using Arc welding.
12. Demonstration on machine tools.

REFERENCES :

Lab. Manual

III SEMESTER

S134 - APPLIED MATHEMATICS – III

(Common to AE, CE, CSE, EEE, EIE, IT, ME)

Prerequisite: Applied Mathematics-II, Applied Mathematics-II

Course Educational Objectives:

In this course student will learn about

1. The methodology of interpolation and extrapolation to common problems using different formulae
2. The application of Numerical Techniques in Integration; solving the algebraic and transcendental equations.
3. Solving Differential equations by using Numerical Methods..
4. The concepts of Vector Calculus Vector Differentiation and Conservative Fields.
5. The concepts of line integrals, surface and volume integrals, vector integral theorems and their applications

Course outcomes:

At the end of this course student will be able to

1. Apply the knowledge acquired to identify, formulate and solve problems in engineering using Numerical Techniques.
2. Apply the techniques of numerical interpolation and approximation of functions with ease.
3. Perform integration of functions when the actual function is not given and solve algebraic and transcendental equations.
4. Solve Ordinary Differential Equations with given initial conditions.
5. Apply Integration to find length, area and volume of any given surface.

UNIT – I

SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS AND NUMERICAL INTEGRATION

Solutions of Algebraic and Transcendental Equations – Regula False Position method and NewtonsRaphson Method in one variable.Numerical Integration – Trapezoidal rule – Simpson's 1/3 Rule –Simpson's 3/8 Rule.

UNIT – II

INTERPOLATION AND FINITE DIFFERENCES

Interpolation: Introduction – Finite differences- Forward Differences- Backward Differences- Backward differences –Central differences – Symbolic relations and separation of symbols-Differences of a polynomial- Newton's formulae for interpolation – Lagrange's Interpolation formula.

UNIT – III

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

Numerical solution of Ordinary Differential equations, Solution by Taylor's series - Picard's Method of successive Approximations - Euler's Method - Runge- Kutta Methods.

UNIT – IV

VECTOR DIFFERENTIATION

Vector Differentiation: Gradient- Directional Derivatives -Divergence – Solenoidal fields- Curl –Irrotation fields-potential surfaces - Laplacian and second order operators and related properties of sums and products

UNIT – V

VECTOR INTEGRATION

Vector Integration - Line integral – work done –area - surface and volume integrals Vector integral theorems: Greens, Stokes and Gauss Divergence Theorems (Without proof) and related problems.

TEXT BOOKS

1. S. S. Sastry, "Introductory Methods of Numerical Analysis". Prentice Hall of India,5th Edition,2005.
2. Dr. B. V. Ramana, "Higher Engineering Mathematics", The McGraw Hill Companies, 1st Edition,2010.

REFERNCES

1. Dr. B.S. Grewal , "Higher Engineering Mathematics", Khanna Publishers, 42ndEdition,2012.
2. Steven .C. Chopra and Ra. P. Canale, "Numerical Methods for Engineers with programming and software application", The McGraw Hill Companies, 4th Edition,2002.
3. M. K. Jain, S. R. K. Iyengar, R.K. Jain, "Numerical Methods for Scientific and Engineering Computation", New Age International Publishers., 5th Edition,2007.

III SEMESTER

S408 - THERMODYNAMICS

(Common to AE, ME)

Prerequisite Subject: Basic Mechanical Engineering

Course Educational Objectives:

To understand the basic concepts of energy conversions and fundamentals of thermodynamics and its application.

1. To acquire the knowledge of first law of thermodynamics and its analysis.
2. To learn the second law of thermodynamics and significance of entropy principles.
3. To learn the concepts of reactant, non-reactant gas mixtures and pure substance.
4. To understand the significance of various thermal cycles.

Course Outcomes:

After completion of the course students are able to:

1. Analyze the concepts of heat, work, and energy and temperature measurement.
2. Apply the first law of thermodynamics to various thermal systems for analysis.
3. Analyze the irreversibilities of various systems using second law of thermodynamics.
4. Demonstrate and analyze the different gas mixtures and pure substances.
5. Apply ideal cycle analysis to simple heat engines to estimate various performance parameters.

UNIT - I

BASIC CONCEPTS AND DEFINITIONS: Introduction, Macroscopic and Microscopic View Point, Continuum, System, Control Volume, Properties of System, State, Path, Process, Cycle and Equilibrium-Thermodynamic Equilibrium, Quasi static process, Temperature-Temperature Scales, Zeroth law of Thermodynamics, Energy-Forms of Energy, Heat, Work, Mechanical forms of Work, Path and Point Functions.

UNIT - II

FIRST LAW OF THERMODYNAMICS: Introduction, Energy A Property of System, First Law Analysis of Closed System, Displacement work, Thermodynamic processes, Different Forms of Stored Energy –Energy Balance, Internal Energy, Specific Heat, Enthalpy, Entropy, PMM1.

FIRST LAW ANALYSIS OF CONTROL VOLUME-Conservation of Mass, Conservation of Energy Principle-Flow work, The Steady Flow Process-Steady Flow Energy Equation, Steady Flow Engineering Devices-Nozzles, Diffusers, Turbine, Compressors, Throttling Valves, Heat Exchangers.

UNIT - III

SECOND LAW OF THERMODYNAMICS: Introduction, Thermal Energy Reservoirs, Heat Engines, Kelvin-Plank &Clasius Statements of Second law of Thermodynamics, Refrigerators, Heat Pumps, Equivalence of Kelvin-Plank and Clasius Statements, Perpetual Motion Machines, Reversible and Irreversible Process, Carnot Cycle, Carnot Theorem, Corollary of Carnot's Theorem Thermodynamic Temperature Scale.

ENTROPY: Introduction,Clausius Theorem , Clasius Inequality, T-S Plot, Principle of increase of entropy, Tds-Relations, Maxwell Relation, Entropy Change for Ideal gases, Isentropic relations for ideal gases, Third Law of Thermodynamics.

UNIT - IV

NON REACTIVE GAS MIXTURES: Introduction, Composition of Gas Mixture, Mass Fraction, Mole Fraction, Daltons Law of Additive Pressures, Amagat`s Law of Additive Volumes, Ideal Gas Mixtures.

PROPERTIES OF PURE SUBSTANCE: Introduction, Phases of Pure Substance, Properties of steam, dryness fraction, Phase Change Processes, Property Diagrams of (P-v, P-T, T-s.)Pure Substance, P-v-T Surface, , h-s Diagram or Mollier Diagram for a Pure Substance .

UNIT - V

GAS POWER CYCLES: Introduction, Analysis of Power Cycles- Carnot, Otto, Diesel, Dual, andBrayton Cycles

VAPOR POWER CYCLES: Analysis of Carnot Vapour Cycle, Simple Rankine Cycle.

REFRIGERATION CYCLES: Reversed Carnot Cycle, Bell-Coleman Cycle, Simple Vapour Compression Cycle.

TEXT BOOKS

1. P.K.Nag ,"Engineering Thermodynamics"- 5th Edition, McGraw-Hill, 2013.
2. Cengel, Y.A and Boles, M.A"Thermodynamics: An Engineering Approach",7th Edition, 2011, McGraw-Hill.

REFERENCES

1. G.J.VanWylen& Sonntag, "Fundamentals of Thermodynamics", John Wiley& sons, publicationsInc. 5th Edition 1998.
2. E.Rathakrishnan, "Fundamentals of Engineering Thermodynamics", 2nd Edition 2010 PHI.

III SEMESTER

S309 - METALLURGY AND MATERIAL SCIENCE

(Common to AE, ME)

Prerequisite Subject: Basic Mechanical Engineering

Course Educational Objectives:

The objectives of this course are:

1. To acquire knowledge on structure of metals and alloys.
2. To understand the concept of equilibrium diagrams.
3. To learn the basic concepts of ferrous materials.
4. To understand the concepts of mechanical working process and heat treatment
5. To acquire the basic concepts on non-ferrous and composite materials.

Course Outcomes:

After completion of the course students will be able to:

1. Estimate the properties of the material based on crystal structures.
2. Develop the equilibrium diagram for any binary system.
3. Determine the properties of steels based on Fe-Fe_3C equilibrium diagram.
4. Apply the principle of heat treatment to get desired properties in materials.
5. Distinguish between non ferrous metals and composite materials.

UNIT – I

STRUCTURE OF METALS: Crystal structures-Body cantered cubic, Face cantered cubic, closed packed hexagonal, crystallographic planes. Mechanism of crystallization of metals, grain and grain boundaries, Effect of grain boundaries on the properties of metal / alloys – Determination of grain size.

CONSTITUTION OF ALLOYS: Necessity of alloying, Solid solutions-Interstitial Solid Solution and Substitution Solid Solution, Hume Rotherys rules.

UNIT - II

EQUILIBRIUM DIAGRAMS: Experimental methods of construction of equilibrium diagrams, Classification of equilibrium diagrams- isomorphous, eutectic, partial eutectic equilibrium diagrams. Equilibrium cooling and heating of alloys, lever rule, coring. Transformations in the solid state – allotropy, eutectic, eutectoid, peritectoid reactions.Study of Cu-Ni and Bi-Cd equilibrium diagrams.

UNIT - III

FERROUS METALS AND ALLOYS: Study of Iron-Iron carbide equilibrium diagram.

STEEL: Classification of steels, structure, properties and applications of plain carbon steels-low carbon steel, medium carbon steel and high carbon steel.

CAST IRONS: structure, properties and applications of white cast iron, malleable cast iron, grey cast iron, spheroidal graphite cast iron.

UNIT - IV

MECHANICAL WORKING: Hot working, Cold working, Strain hardening, Recovery, Recrystallisation and Grain growth. Comparison of properties of cold and hot worked parts.

HEAT TREATMENT OF ALLOYS: Annealing, normalizing and hardening. Construction of TTT diagram for eutectoid steel. Harden ability-determination of harden ability by jominy end quench test. Surface - hardening methods and age hardening treatment and application .

UNIT - V

NON-FERROUS METALS AND ALLOYS: structure, properties and applications of copper and its alloys, Aluminium and its alloys.

COMPOSITE MATERIALS: Classification of composites, various methods of component manufacture of fiber reinforced composites-Hand layup process, Filament winding process, SMC processes, Continuous pultrusion processes, Resin transfer moulding.

Introduction to metal ceramic mixtures, Metal – Matrix composites and C – C composites and applications

TEXT BOOK

1. Sidney H. Avener, Introduction to Physical Metallurgy, Tata McGraw-Hill, 3rd Edition, 2011.
2. V.D.Kotgire, S.V.Kotgire, Material Science and Metallurgy, Everest Publishing House, 24th Edition,2008.

REFERENCES

1. Richard A.Flinn, Paul K.Trojan, Engineering Materials and Their Applications, Jaico Publishing House, 4th Edition, 1999.
2. William and callister, Materials Science and engineering, Wiley India private Ltd., 2011.
3. U.C Jindal and Atish Mozumber ,Material since and metallurgy , Pearson education-2012

III SEMESTER

S305 - MECHANICS OF MATERIALS

Prerequisite Subject: Basic Mechanical Engineering

Course Educational Objectives: The objectives of this course are

1. To understand basic concepts of stress, strain and relations based on linear elasticity.
2. To demonstrate the shear bending diagrams on beams & know the location & magnitude of the bending moment.
3. To understand theory of simple bending.
4. To understand the graphical and analytical methods to compute principal stresses and strains.
5. To familiarize the concepts of cylinders & shells subjected to internal & external pressures.

Course Outcomes:

After completion of the course students will be able to

1. Compute the stresses and deformations of a member due to an axial loading under uniform and non-uniform conditions.
2. Find the maximum bending stress in the beams from SFD and BMD diagrams.
3. Analyze and design the structural members subjected to tension, compression, bending & torsion.
4. Solve problems related to pure bending of beams and other simple structures.
5. Calculate combined stresses and strains at a point across any plane in a two dimensional system and principal stresses.
6. Apply the torsion equation to compute torsional stresses in solid and hollow shafts.

UNIT - I

SIMPLE STRESSES AND STRAINS: Stresses and strain due to axial force. Hooke's law, Factor of safety, Stepped bars – Uniformly varying sections - Stresses in composite bars due to axial force and temperature - Strain energy due to axial force, Stresses due to sudden loads and impact - Lateral strain - Poisson's ratio - Change in volume – Shear stress - Shear strain - Relationship between elastic constants

UNIT - II

SHEAR FORCE AND BENDING MOMENT: Relationship between loading, Shear force and Bending moment - Shear force and Bending moment diagrams for Cantilever, Simply supported and Overhanging beams subjected to Concentrated loads and Uniformly distributed loads only - Maximum bending moment and Point of contra flexure.

UNIT – III

STRESSES IN BEAMS: Theory of simple bending - Assumptions - Derivation of flexure equation – Section modulus - Normal stresses due to flexure application.

TORSION: Theory of Torsion - Assumptions - Derivation of torsion equation - Polar modulus, Power transmitted by a shaft, Stresses in solid and hollow circular shafts

UNIT - IV

ANALYSIS OF STRESSES IN TWO DIMENSIONS: State of stress at a point, Normal and Tangential stresses on inclined planes - Principal stresses and their planes - Plane of maximum shear - Mohr's circle of stresses.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beam cross sections like Rectangular, Circular, Triangular, I and T Sections.

UNIT - V

DEFLECTION OF BEAMS: Differential equation of elastic line - Deflection in statically determinate beams - Macaulay's method for prismatic members

THIN, THICK AND SPHERICAL SHELLS: Hoop and longitudinal stress- Thin and Thick cylinders- Spherical shells-Changes in dimensions and volume.

TEXT BOOK

1. Popov, E.P., Engineering Mechanics of Solids, PHI, 2nd Edition, 2009
2. Sadhu Singh, Strength of Materials, Khanna Publishers, 10th Edition, reprint 2013.

REFERENCES

1. S.Ramamrutham, Strength of Materials, 14th Edition, DhanpatRai& Sons,2011.
2. M.L.Gambhir, Fundamentals of Solid Mechanics, PHI Learning, 2009
3. M.Chakraborti, Strength of Materials, S.K.Kataria& Sons.
4. R.Subramanian, Strength of Materials, 2nd Edition, Oxford University Press, 2010.
5. R.K.Bansal, Strength of Materials, 15thEdition, Laxmi Publishers, 2013.
6. James M.Gere, Barry J.Goodno, Mechanics of Materials, 7thEdition, Cengage Learning, 2009.

III SEMESTER

S208 - ELECTRICAL AND ELECTRONICS ENGINEERING

(Common to CE, ME)

Prerequisite: There are no prerequisites for this course**.**

Course Educational Objectives:

The aim of this course is to study the working principles of electrical circuits, provide knowledge and skills needed to calculate efficiency of different machines, basic working principles of different electronic circuits and also prepare the students to understand the working principles of different electrical and electronic measuring instruments.

Course outcomes:

After completion of the course students will be able to:

1. Identify a suitable machine for particular application.
2. Analyze different types of resistive networks.
3. Use the techniques to measure efficiency and regulation of AC Machines.
4. Understand the working of electrical and electronics measuring instruments.
5. Demonstrate the characteristics of different electronic devices.

UNIT – I

ELECTRICAL CIRCUITS

Basic definitions, Types of elements-active and passive, Ohm's Law, Kirchhoff's Laws-Network reduction techniques-series, parallel, star to delta ,delta to star transformations, source transformations(for resistive networks).

UNIT – II

TRANSFORMERS

Principle of operation of single phase transformers, Ideal transformer, Practical transformer – Emf equation-Losses- efficiency-O.C and S.C Test.

UNIT – III

A.C MACHINES

ALTERNATORS: Fundamentals of Alternating Current-Principle of operation of alternators –Salient pole and Non-Salient pole rotors, Voltage Regulation by synchronous impedance method only.

INDUCTION MOTOR: Principle of operation of induction motors –Slip ring and Squirrel cage motors –Slip-Torque characteristics.

UNIT – IV

DIODE AND TRANSISTORS

P-n junction diode, symbol, V-I Characteristics, Diode Applications, Rectifiers – Half wave, Full wave and Bridge rectifiers ,PNP and NPN Junction transistor & configurations, Application of transistor – amplifier.

UNIT – V

ELECTRICAL AND ELECTRONICS MEASURING INSTRUMENTS.

Basic Principles of indicating instruments – permanent magnet moving coil and moving iron instruments.Block diagram of CRO andCRT (Cathode Ray Tube), Applications of CRO - Voltage, Current and frequency measurements.

TEXT BOOKS

1. M.S Naidu and S. Kamakshaiah ,"Introduction to Electrical Engineering":-TMH Publication.
2. Millman and Halkias ," Electronic Devices and Circuits"- Tata McGraw Hill.

REFERENCES

1. Kothari and Nagarath –"Basic Electrical Engineering ", TMH Publications, 2nd Edition.
2. K.LalKishore , "Electronic Devices and Circuits ", B.S Publication.
3. WH Hayt, JE Kemmerly, SMDurbin, "Engineering Circuit Analysis ", Tata McGraw Hill Publication, 6th Edition.

III SEMESTER

S293 - MACHINE DRAWING

Course Educational Objectives: Engineering Graphics

The main objectives of the course are

1. To learn basic conventions adopted in machine drawing.
2. To familiarize the machine elements such as screw fasteners, couplings & bearings used in design.
3. To learn the mechanical components like cotter and knuckle joints used in design.
4. To understand the assembly drawings for engine parts, machine parts, valves etc.

Course Outcomes:

After completion of the course students are able to:

1. Develop and/or comprehend basic conventions needed for machine drawing
2. Apply the conventions of machine elements while designing standardized parts
3. Apply the ideas and make design calculations correctly.
4. Design the drawings of mechanical components and their assemblies along with their utility for design of components.
5. Develop the new product drawings for the industry needs.

I. MACHINE DRAWING CONVENTIONS

Need for drawing conventions – introduction to IS conventions

a) Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs and ribs.

b) Types of sections – selection of section planes and drawing of sections and auxiliary sectional views, Parts not usually sectioned.

c) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.

d) Title boxes, their size, location and details - common abbreviations & their liberal usage

e) Types of Drawings – working drawings for machine parts.

II.DRAWING OF MACHINE ELEMENTS AND SIMPLE PARTS

1. Sections of Solids : Introduction, Sections prisms, Pyramids, Cylinders and cones
2. Selection of views, additional views for the following machine elements and parts with every drawing proportion.

a) Popular forms of screw threads, bolts, nuts, stud bolts, tap bolts and set screws.

b) Keys, cottered joints and knuckle joint.

c) Riveted joints for plates

d) Shaft coupling, spigot and socket pipe joint.

e) Journal, pivot and collar and foot step bearings.

III.ASSEMBLY DRAWINGS

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

a) **Engine parts** – Stuffing box, Cross head, Eccentric, Connecting rod, Piston assembly.

b) **Other machine parts** - Screws jack, Bench Vice, Pipe vice, Plummer block, Tailstock.

TEXT BOOKS

1. K.L.Narayana, P.Kannaiah& K. Venkata Reddy, Machine Drawing, 4th Edition 2004 New Age Publishers.
2. P.S Gill, Machine Drawing, 18th Edition 2013 Eastern Publishers.

REFERENCES

1. N.Sidheshwar, Machine Drawing, 4th Edition 2001 Tata McGraw Hill
2. Dhawan, Machine Drawing, revised edition 2002 S.Chand Publications
3. K. C. JOHN, Machine Drawing 6th Edition 2007 Stronck publishers
4. N.D.Bhatt, V.M.Panchal Machine Drawing 2005Charotar Publishing House

III SEMESTER

S243 - ENVIRONMENTAL STUDIES

(Common to all branches)

Course Educational Objectives:

In this course the student will learn about

1. Environmental issues related to local, regional and global levels.
2. Concepts of ecosystems and threats to global biodiversity.
3. Environmental pollution problems.
4. Environmental issues in the society.
5. Problems associated with over population and burden on environment.

Course Outcomes:

After the completion of this course, the students will able to

1. Evaluate local, regional and global environmental issues related to resources and management.
2. Understand the implications of the ecosystems and identify the threats to global biodiversity
3. Address and prevent the problems related to pollution of air, water and soil.
4. Investigate and solve social issues of the environment.
5. Create awareness on the concept of sustainable population growth.

UNIT – I

NATURAL RESOURCES: Definition, Scope and importance of Environmental Studies – Need for Public Awareness. Renewable and non-renewable resources –
Natural resources and associated problems – Forest resources, Water resources, Mineral resources, Food resources and Energy resources.

UNIT - II

ECOSYSTEMS: Concept of an ecosystem - Structure and functions of an ecosystem - Producers, consumers and decomposers. Energy flow in the ecosystem, Ecological succession, Food chains, Food webs and ecological pyramids.Bio-Geo Chemical Cycles.
Biodiversity and its conservation: **Introduction** – Definition & Levels of Measuring Biodiversity: Genetic, Species, Community and Ecosystem diversity.
Bio-geographical classification of India, India as a mega diversity nation, Values of Biodiversity: Direct and Indirect Values, Hot-spots of biodiversity, Threats to biodiversity, Man-wildlife conflicts, Endangered and endemic species of India. Conservation of biodiversity.

UNIT - III

ENVIRONMENTAL POLLUTION: Definition, Sources, Effects and Control measures of

a) Air pollution
b) Water pollution
c) Soil pollution
d) Noise pollution
e) Radioactive Pollution

SOLID WASTE MANAGEMENT: Sources of waste, Effects of improper handling of waste and measures to reduce the waste production and management methods of Municipal solid waste.
DISASTER MANAGEMENT: Floods, Earthquakes, Cyclones, Landslides and Tsunami.

UNIT - IV

SOCIAL ISSUES AND THE ENVIRONMENT: From Unsustainable to Sustainable development & Equitable use of resources for sustainable life style - Environment and human health - Resettlement and Rehabilitation of people, its problems and concern & Case Studies - Climate change: Global warming, Acid rains, Ozone layer depletion, Nuclear accidents and Holocaust & Case studies - Consumerism and waste products.

UNIT -V

HUMAN POPULATION AND THE ENVIRONMENT: Population growth & Variations among Nations, Population explosion – Family Welfare Program - Human Rights - Value Education - HIV/AIDS - Women and Child Welfare - Role of Information Technology in Environment and human health & Case Studies. Environmental legislation in India.

TEXT BOOKS

1 P.N.Palanisamy et al., "Environmental Science" 2nd edition, Dorling Kindersley (India) Pvt.Ltd. Licenses of Pearson Education in South Asia, 2013.

2 R. Rajagopalan, "Environmental Studies (From Crisis to Cure)", by Oxford University Press, 2011, 2nd Edition.

REFERENCES

1. M. Anji Reddy, "Textbook of Environmental Sciences and Technology" by BS Publications, 2011 2nd Edition.
2. ErachBharucha, "Textbook of Environmental Studies for Undergraduate Courses", by University Grants Commission, University Press (India) Private Limited, 2005. (2010 Reprinted).

III SEMESTER

L159 - MATERIAL TESTING AND METALLURGY LAB

Prerequisite Subject: Metallurgy and Material Science

Course Educational Objectives:

The main objectives of the course are

1. To determine the various mechanical properties of materials under different loading conditions.
2. To predict the behavior & properties of various materials by observing the microstructure

Course Outcomes:

After completion of the course students are able to:

1. Analyze and design machine/structural members subjected to tension, compression, torsion by computing the allowable stresses
2. To select material for a practical application.
3. Estimate the properties from the microstructure of materials.

PART-A :MATERIAL TESTING

Any six experiments may be conducted

List of Experiments:

1. Compression test on helical spring.
2. Tension test on mild steel rod.
3. Double shear test on metals.
4. Torsion test on mild steel rod.
5. Impact test on metal specimen.
   (a) Izod Impact Test
   (b) Charpy Impact Test
6. Hardness test on metals.
   (a) Rockwell Hardness Test
   (b) Brinell Hardness Test
7. Deflection test on beams.
   (a) Cantilever Beam
   (b) Simply Supported beam
8. Compression test on brittle materials

PART-B: METALLURGY LAB

Any six experiments may be conducted

1. Preparation and study of the microstructure of pure metals like Iron, Cu and Al.
2. Preparation and study of the microstructure of low carbon steels, medium carbon steel and high carbon steels.
3. Study of the microstructures of gray cast iron, malleable cast iron and nodular cast iron.
4. Study of the microstructures of brass.
5. Study of the microstructures of heat treated steels.
6. Hardenability of steels by Jominy end quench test.
7. Hardness of various treated and untreated steels.

REFERENCE BOOKS

Lab Manual

III SEMESTER

L133 - ELECTRICAL AND ELECTRONICS ENGINEERING LAB

Prerequisite: There are no prerequisites for this lab course**.**

Course Educational Objectives:

This lab course is intended to know the usage of electrical and electronics equipment, understand the characteristics of PN junction diode, transistor, and amplifiers and also understand the performance characteristics of transformers, induction motor and alternator

Course outcomes:

After undergoing this lab course, students will be able to:

A. Demonstrate the usage of various electronic components and test equipments like Multimeter, function generator, CRO
B. Decide the use of diode and transistor for various practical applications.
C. Design the circuits to verification of Kirchhoff's laws.
D. Design amplifier circuit with different biasing techniques.
E. Identify the suitable method to find out the performance characteristics of AC machines

LIST OF EXPERIMENTS

Brake test on 3-phase Squirrel Cage Induction Motor.

1. Regulation of 3-phase Alternator by Synchronous Impedance Method.
2. OC and SC tests on 1-phase transformer.
3. Separation of core losses of 1-phase transformer.
4. Load test on 1-phase transformer.
5. Verification of Kirchhoff's Laws (KCL and KVL.)
6. Measurement of peak, average, rms values, frequency and time period of a sinusoidal waveform.
7. V-I characteristics of p-n Diode.
8. Transistor Characteristics (Common Base)
9. Calculation of ripple factor for full wave rectifier.

ADDITIONAL EXPERIMENTS

1. CE amplifier.

2. Calculation of ripple factor for half wave rectifier.

REFERENCES :

Lab. Manual

IV SEMESTER

S351 - PROBABILITY AND STATISTICS
(Common to CSE, IT, ME)

Prerequisite Subject: Applied Mathematics-I,II

Course Educational Objectives:

The main objectives of this course are

1. To revise elementary concepts and techniques encountered in probability.
2. To extend and formalise knowledge of the theory of probability and random variables.
3. To introduce new techniques for carrying out probability calculations and identifying probability distributions.
4. To motivate the use of statistical inference in practical data analysis.
5. To study elementary concepts and techniques in statistical methodology.

Course Outcomes:

This course is intended to contribute to the following program outcomes:

1. An ability to apply the knowledge of mathematics, science and engineering.
2. An ability to design and conduct experiments, as well as to analyze and interpret data
3. An ability to identify, formulate and solve engineering problems.
4. An ability to use the techniques, skills and modern probabilistic and statistical tools necessary for engineering practice

UNIT - I
PROBABILITY AND RANDOM VARIABLES
Conditional probability – Multiplication theorem-Baye's theorem.Random variables – Discrete and continuous Random Variables and their distribution functions, Mathematical Expectation of Univariate Random Variable.

UNIT - II
PROBABILITY DISTRIBUTIONS
Probability Distributions-. Binomial, Poisson, Normal and Gamma distributions- related properties, simple applications. Moment Generating Function and properties. Moment Generating Function for standard distributions.

UNIT - III
SAMPLING DISRIBUTION AND ESTIMATION
Population and samples.Sampling distribution of mean (with known and unknownvariance), proportion, variances. - Sampling distribution of sums and differences. Point andinterval estimators for mean, variance and proportions.

UNIT - IV
TESTING OF HYPOTHESIS
Null and Alternative Hypothesis, One tail and two tailed tests,Type I and Type II errors. Testing of hypothesis concerning means, proportions and their differences using Z-test.Tests of hypothesis using Student's t-test, F-test and χ^2 test. Applications of decision making using the above tests.

UNIT - V
CORRELATION AND CURVE FITTING
Simple Bivariate Correlation and Regression lines.Curve fitting: Fitting a straight line – Second degree curve-exponential curve by method of least squares and goodness of fit.

TEXT BOOKS

1. Miller & Freund's "Probability and Statistics for Engineers" Prentice Hall of India, New Delhi, 8th edition. 2011.
2. William W. Hines "Probability and Statistics in Engineering" John Wiley & Sons, 4th edition.2002

REFERENCES

1. Jay L.Devore "Probability and Statistics for engineering and the sciences." Cengage Learning india, 8th edition, 2012.
2. S.C.Gupta&V.K.Kapoor "Fundamentals of Mathematical Statistics" Sultan Chand and sons, New Delhi. 11thedition 2002.
3. T.K.V.Iyangar "Probability and Statistics" S.Chand& Company, New Delhi, edition 2012.
4. B.V.Ramana "Higher Engineering Mathematics" TMH, New Delhi, 1st Edition, 2010.

IV SEMESTER

S252 - FLUID MECHANICS AND HYDRAULIC MACHINERY

Prerequisite Subject: Basic Mechanical Engineering

Course Educational Objectives:

1. To learn the properties of fluids and its measuring devices
2. To learn about the different types of fluid flows and forces behind the flow.
3. To learn the basics of turbo machinery.
4. To learn the working of hydraulic prime movers.
5. To know the working of different types of pumps

Course Outcomes:

After completion of the course students are able to:

1. Develop devices based on basic principles in fluid flows
2. Able to calculate velocity fields potentials and forces on bodies and realize the concepts of buoyant force, centre of buoyancy.
3. Design different types of flow systems that fulfill the needs of industry.
4. Develop an ability to design the simple hydraulic systems to cater the needs of society and industry.
5. Analyze different types of working pumps

UNIT-I

FLUID STATICS: Dimensions and Units: Physical Properties of Fluids- Specific Gravity-Viscosity, Surface Tension, Vapour Pressure and Their Influence on Fluid Motion-Atmospheric Gauge and Vacuum Pressure-Measurement of Pressure-Piezometer, U-Tube and Differential Manometers, Hydro-Static Forces on Submerged Bodies

UNIT-II

FLUID KINEMATICS: Stream Line, Path Line, Streak Line, Stream Tube, Classification of Flows-Steady & UN Steady, Uniform and Non Uniform, Laminar, Turbulent, Rotational and Irrotational Flows-Equation of Continuity For One Dimensional Flows.

FLUID DYNAMICS: Surface and Body Forces-Euler's Equation, Bernoulli's Equations For Flow along a Stream Line, Momentum Equation and Its Application on Force on Pipe Bend. Reynolds Experiment, Darcy's -Weisbach Equation-Minor Losses In Pipes, Pipes In Series ,Parallel-Total Energy Line-Hydraulic Gradient Line, Measurement Of Flow-Pitot Tube, Venturimeter, Orifice Meter,

UNIT-III

BOUNDARY LAYER FLOW: Laminar & Turbulent Boundary Layer, Boundary Layer Thickness, Displacement Thickness, Energy Thickness, Momentum Thickness, Boundary Layer Separation.

IMPACT OF JETS: Hydro dynamic forces of Jets on Stationary and moving flat, Inclined, Curved vanes, Jet striking centrally and a tip for Symmetrically and Un-symmetrically vanes, Velocity diagrams, work done and efficiency, Flow over radial vanes,

UNIT-IV

HYDRAULIC TURBINES: Classification of Turbines, Pelton Wheel, work done and efficiencies of Pelton Wheel, Working proportions of Pelton Wheel, Francis Turbine, work done and efficiencies of Francis Turbine, Working proportions of Francis Turbine, Kaplan Turbine, work done, heads& efficiencies, Draft Tube, Draft Tube Theory, Types Of Draft Tubes, Governing of Turbines, Unit Quantities And Specific Quantities, Geometric Similarity, Cavitation In Turbines, Performance Characteristic Curves.

UNIT-V

CENTRIFUGAL PUMPS: Working of Centrifugal Pumps, Types of Centrifugal Pumps, Work done by The Impeller - Losses and Efficiencies, Specific Speed, Pumps In Series, Parallel-Performance Characteristics Curves, NPSH.

RECIPROCATING PUMPS: Main components and working of a Reciprocating Pumps, Types of Reciprocating Pumps, work done by Reciprocating Pump, Single, Double, Co-Efficient of Discharge, Percentage of Slip and Negative slip of pump, Indicator diagrams, Air vessels.

TEXT BOOKS

1. P.N.Modi and S.M.Seth, Hydraulics, Fluid Mechanics and Hydraulic Machinery, 15th Edition, Standard Book House, 2004.
2. Philip J, Robert W.fox, Fluid mechanics,7th edition, John Wiley &sons,2011.

REFERENCES

1 R.K.Bansal, Fluid Mechanics and Hydraulic Machines, 9th Edition, laxmi publications.
2. Banga& Sharma, Hydraulic Machines, Edition, Khanna publishers, 6th Edition,1999
3. RamaDurgaiah, Fluid Mechanics and Machinery, Edition, New Age International, 1stedition,2006
4. D.S. Kumar, Fluid Mechanics and Fluid power engineering, 5th Edition, S.K. Kataria& Sons.

IV SEMESTER

S354 - PRODUCTION TECHNOLOGY

Prerequisite Subject: Work Shop

Course Educational Objectives:

The main objective of the course is to

1. Understand the various production or manufacturing processes which could be done in real time.
2. Get familiarize with various casting processes.
3. Demonstrate different types of welding processes and welding defects.
4. Understand the basic concepts of welding techniques.
5. Create awareness on the concepts of different metal forming processes.
6. Understand the concepts of extrusion and sheet metal forming processes.

Course Outcomes:

After completion of the course students are the able:

1. To work in manufacturing industries.
2. To optimize the production processes in industries.
3. To apply production processes to various engineering problems.
4. To analyze the various production processes used for different field of applicability with respect to consideration of various design aspects.

UNIT – I

CASTING: Steps involved in making a casting – Advantage and limitations of casting and its applications. –Patterns– Types of patterns and pattern allowances, pattern Materials, Cores and core prints, Chaplets–Moulding sands and Properties of moulding sand, Principles of Gating system,types of gates and Gating ratio, Risers– Types, Function and Design, Special casting processes 1) Centrifugal 2) Die, 3) Investment.

UNIT - II

WELDING: Classification of welding process, Principle of gas welding,Oxy- acetylene welding equipment, Process and applications, Hydrogen welding,Gas cutting process and applications.

RESISTANCE WELDING-Principle and types of resistance welding and applications, Thermit welding, friction welding, explosive welding and induction welding.

UNIT - III

ELECTRIC ARC WELDING: Principle, equipment, electrodes and electrode polarities, Consumable and non consumable welding process. MIG welding, Sub-merged arc welding (SAW) processes and applications. Inert Gas welding, Tungsten Inert Gas Welding (TIG) process and applications, Carbon arc welding. Soldering & Brazing processes and applications. Welding defects, causes and remedies

UNIT – IV

METAL FORMING PROCESSES: Nature of plastic deformation, Hot working and Cold working, Principles of Rolling fundamentals – Theory of rolling, Types of Rolling mills, Drawing and its types – Wire drawing and Tube drawing – Coining – Hot and cold spinning processes.

FORGING: Principles of forging – Tools and dies – Types of forging operations – Smith forging, Drop Forging and Machine forging, Forging defects, Causes and remedies.Applications of forming and forging processes.

UNIT – V

EXTRUSION OF METALS: Basic extrusion process, its characteristics and applications. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion, and Hydrostatic extrusion.

SHEET METAL OPERATIONS: Stamping, Forming and other cold working processes, Blankingand piercing – Bending and stretch forming, Embossing and coining.

TEXT BOOKS

1. P.N. Rao ,Manufacturing Technology, TMH, 2nd Edition, 2004.
2. Richard W Heine, Philp Rosenthal& Karl R.Loper, Principles of metal casting, TMH Edition, 2000.

REFERENCES

1. S. Kalpakjain, S.R.Schmid, Manufacturing Engineering and Technology, Pearson Edu., 4th Edition, 2001.
2. R.K. Jain , Production Technology /Khanna Publishers, 17th Edition, 2012.
3. Lindberg, Process and materials of manufacturing, PE.
4. Sarma P C, Production Technology, S Chand & Company Ltd, 3rd Edition, 2012.
5. B.S. Raghuvamsi, Workshop Technology, Dhanapatirai and co. 10th Edition, 2011.

IV SEMESTER

S286 - KINEMATICS OF MACHINES

Course Educational Objectives: The objectives of this course are

1. To understand the concepts of mechanisms and need in machines/systems
2. To understand kinematic analysis on mechanisms (reciprocating & rotary)
3. To understands the concepts of instantaneous centre and velocity and accelerations of the links of mechanism.
4. To study the various steering gears used in automobiles and power transmitting capacity of belt drives
5. To understand the kinematics of cam design
6. To know the kinematics of gears and gear trains.

Course Outcomes:

By the end of this course each student will be able to

1. Analyze the kinematics of linkages to determine position, velocity and acceleration variation throughout the range of motion.
2. Develop ability to come up with innovative ideas regarding mechanisms/machines
3. Determines the velocity & accelerations of various links of any mechanism
4. Design cams or gear trains to produce a desired motion.
5. Calculate the speeds of the gears of an automobile or machine tools

UNIT - I

MECHANISMS: Elements – Classification –Types of kinematic pairs –Types of motions – Degree of freedom- Mechanism and Machines – Classification of machines – Kinematic chain – Inversion of mechanism - Inversions of quadric cycle chain – Single and Double slider crank chains

STRAIGHT LINE MOTION MECHANISMS: Exact and approximate copiers and generated types –Peaucellier, Hart and Scott Russul – Grasshopper – Watt - Chebicheff and Robert Mechanisms

UNIT - II

VELOCITY AND ACCELERATION ANALYSIS: Absolute and Relative motions-Instantaneous centre - Kennedy's theorem- Determination of angular velocity of points and links for simple mechanisms -Relative velocity method –Velocity Polygon-Acceleration Polygon- Velocity and acceleration diagrams for simple mechanisms - Klein's construction-Coriolis acceleration.

STEERING GEARS: Conditions for correct steering – Davis Steering gear- Ackerman steering gear

UNIT - III

HOOKE'S JOINT: Single Hooke's joint –Limitation - Double Hooke's joint – Problems.

CAMS: Classification of Cam and Follower mechanism-Terminology - Types of follower motion - Uniform velocity – Simple harmonic motion and Uniform acceleration-Displacement diagrams- Derivations of follower motion -Graphical layouts of cam profiles-Introduction to tangent cams with straight flanks.

UNIT - IV

BELT AND ROPE DRIVES: Introduction - Selection of belt drive- Types of belt drives-materials - Velocity ratio- Slip -Creep - Tensions for flat belt drive-Angle of contact-Centrifugal tension- Maximum tension – Ropes drives

UNIT - V

GEARS: Terminology – Law of gearing- Profile for gears- Involute gearing- Velocity of sliding –Interference and Undercutting– Contact ratio- Basics of Helical, Bevel, Worm, Rack and Pinion gears.

GEAR TRAINS: Speed ratio- Train value- Types of Gear trains – Applications - Epicyclic gear trains –Differential gear for an automobile.

TEXT BOOKS

1. Rattan S.S, "Theory of Machines", 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi,2011.
2. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", 2ndEdition, McGraw-Hill, Inc.,1995.

REFERENCES

1. Thomas Bevan, "Theory of Machines", 3rd edition, 3rd impress, CBS Publishers and Distributors, 2013.
2. Rao J.S and Dukkipati R.V, "Mechanism and Machine Theory", 2ndEdition, New Age International, New Delhi, 2007.
3. Sadhu Singh "Theory of Machines", 3rd edition, Pearson Education, 1997.
4. Ballaney.P.L "Theory of Machines", 20th edition, Khanna Publishers,1996.
5. Ambekar A. G.," *Mechanism and Machine Theory"*, 2nd reprint, Prentice Hall of India, New Delhi, 2009.

IV SEMESTER

S407 - THERMAL ENGINEERING

Prerequisite Subject: Thermodynamics

Course Educational Objectives:

1. To learn main features of Rankine cycle and its performance improvement methods
2. To learn about components like boilers, super heater, economizer, reheater, feed water heaters and chimney.
3. To learn the construction, function and performance of a steam nozzle.
4. To learn the salient features of impulse, reaction turbines
5. To learn about different types of condensers and compressors.

Course Outcomes:

After completion of the course students are able to:

1. Identify all the essential components of a thermal power plant and develop methods of reducing losses in a vapor power cycle.
2. Develop the skill of simple design of heat exchange devices like super heater, economizer, reheater, boiler tubes and chimneys.
3. Analyze the significance of nozzles in a vapor power cycle.
4. Develop skills on energy conversions and work transfer from impulse and reaction turbines.
5. Design simple condenser units.

UNIT - I

VAPOUR POWER CYCLES: Introduction, Carnot Vapour Power Cycle, Rankine Cycle, Actual Vapour Power Cycle, Methods to improve efficiency of Rankine cycle, Reheating of steam, Regeneration-Open and Closed Feed Water Heater

COMBUSTION: Types ofFuels for power plant, Adiabatic flame temperature, Stoichiometry

UNIT - II

BOILERS: Introduction, Boiler systems-Function and Classification, Fire Tube–Cornish, Lancashire, Cochran, Water Tube-Babcock and Wilcox, Boiler Mountings and Boiler Accessories.

DRAUGHT SYSTEM: Functions, Types, Natural Draft-Height of chimney for given draught and discharge, Condition for maximum discharge, Efficiency of chimney, Artificial draught- induced and forced.

UNIT - III

STEAM NOZZLES: Introduction**,** Types of nozzle, Flow through nozzles- thermodynamic analysis– assumptions -velocity of nozzle at exit- condition for maximum discharge, critical pressure ratio, Ideal and actual expansion in nozzle, velocity coefficient, Supersaturated flow, degree of super saturation and degree of super cooling -Wilson line

STEAM CONDENSERS: Introduction, Function, Elements of acondenser, Types of Condensers- Jet condensers, Surface Condensers –working

UNIT - IV

STEAM TURBINES: Introduction,Classification, Impulse turbines and reaction turbines

IMPULSE TURBINES: Mechanical details, Working principle, Velocity diagram – effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency. De-Laval Turbine - its features. Methods to reduce rotor speed-Velocity compounding (Curtis Turbine) and Pressure compounding (Rateau Turbine), Combined velocity diagram for a velocity compounded impulse turbine,

REACTION TURBINE: Introduction, degree of reaction. Parsons reaction turbine.

UNIT - V

COMPRESSORS– Introduction, Classification – Reciprocating, Rotary, Centrifugal & Axial compressors

RECIPROCATING: Principle of operation, Work required, Isothermal efficiency, Volumetric efficiency and Effect of clearance volume, Free Air Delivery, Multistatge Compression-Condition for Minimum work

ROTARY: Roots Blower, Vane sealed compressor, principle of working.

CENTRIFUGAL: Principle of operation –Energy transfer-velocity diagram

AXIAL: Principle of operation – velocity triangles and energy transfer per stage, degree of reaction,

TEXT BOOKS

1. Mahesh.M. Rathore, Thermal Engineering,1st Edition, 2012, TMH.
2. R.K.Rajput, Thermal Engineering, 5th Edition 2005, Laxmi publications.

REFERENCES

1. T.D Eastop and A. McConkey, Applied Thermodynamics, Pearson 5th Edition 2013.
2. R. Yadav ,Thermodynamics and Heat Engines,Vol-II,Central Book Depot,5th Edtn,1999.
3. R.S.Khurmi ,Thermal Engineering , First Edition , 2012, S.Chand& Company.
4. P.K Nag, Power Plant Engineering, Edition, 3rd Edition 2012, TMH

IV SEMESTER

S245 - ESTIMATION, COSTING AND ENGINEERING ECONOMICS

Course Educational Objectives:

1. To learn the basic principles of energy conservation and audit.
2. To learn the basic principles of waste heat recovery systems.
3. To learn about planning, organizing and implementing of energy conservation methods in a variety of engineering situations.
4. To learn energy auditing procedures especially used in power plants.
5. To learn the economic issues based on energy utilization in domestic, industrial and commercial sectors.

Course Outcomes:

After completion of the course student will be able to :

1. Develop enough exposure to energy audit and energy conservation methods.
2. Acquire the knowledge on cogeneration plant and its salient features
3. Identify energy conservation opportunities and its implementation in devices like boilers and furnaces etc.,
4. Analyze significance and relevance of waste heat recovery in terms of plant economy and long term goals.
5. Apply the engineering economic principles for different thermal systems of a power plant.

UNIT - I

General energy problem, Energy uses patterns and scope of conversion.

ENERGY MANAGEMENT PRINCIPLE: Need, Organizing and managing an energy management program.

ENERGY AUDITING: Elements and concepts, Type of energy audits instruments used in energy auditing.

UNIT - II

ECONOMIC ANALYSIS: Cash flows, Time value of money, Formulae relating present and future cash flows- single amount, uniform series.

FINANCIAL APPRAISAL METHODS: Pay back periods, net present value, benefit cost ratio, internal rate of return and Life cycle cost / benefits.

UNIT - III

THERMODYNAMICS OF ENERGY CONSERVATION: Energy conservation in Boilers and furnace, Energy conservation in stream and condensate system. **COGENERATION:** Concepts, type of cogeneration system, performance evaluationof a cogeneration system.

UNIT - IV

WASTE HEAT RECOVERY: Potential, benefit, waste heat recovery equipments. Space Heating, Ventilation Air Conditioning (HVAC) and water heating of building, Transfer of heat, space heating methods, Ventilation and air conditioning, Heat pumps, Insulation, Cooling load, Electric water heating systems, Electric energy conversation methods.

UNIT - V

ENERGY CONSERVATION IN ELECTRIC UTILITY AND INDUSTRY: Energy cost and two -part tariff, Energy conservation in utility by improving load factor, Load curve analysis, Energy efficient motors, Energy conservation in illuminating system, Importance of power factor in energy conservation - Power factor improvement methods, Energy conservation in industries.

TEXT BOOKS

1. Wayne C. Turner, **Energy management handbook -**,CRC PressPublications, 2004.
2. S.C. Tripathy, **Electrical Energy Utilization and Conservation -** Tata McGraw-Hill, 1991.

REFERENCES

1. D.A. Reay, **Industrial Energy Conversation -**, Pergamon Press
2. **Industrial energy conservation Manuals**: MIT Press.

IV SEMESTER

S355 - PROFESSIONAL ETHICS AND HUMAN VALUES

(Common to all branches)

COURSE EDUCATIONAL OBJECTIVES:

1. To create an awareness on engineering ethics and human values.
2. To adumbrate the inevitability of different intellectual property rights like patents, copyrights, trademarks, and trade secret.
3. To give an impetus on achieving higher positions in profession, with ethical and human values as a base and support for the growth.
4. To explicate the professional and societal responsibilities of the engineers.
5. To make the student realize the sensitiveness associated with experimentation process

COURSE OUTCOMES:

At the end of the course, the student

1. Acquires the basic concepts of Professional ethics and human values & Students also gain the connotations of ethical theories.
2. Knows the duties and rights towards the society in an engineering profession
3. Would realize the importance and necessity of intellectual property rights.
4. Can take all the necessary precautions while conducting the experiments, which may reduce the risk.
5. Understands the importance of risk evacuation system in reality and takes the utmost responsibility while handling the risky situations

UNIT - I

ETHICS

Senses of 'Engineering Ethics' -Variety of moral issues - Types of inquiry -Moral dilemmas Moral autonomy -Kohlberg's theory Gilligan's theory -Consensus and controversy – Models of Professional Roles -Theories about right action- Self interest - Customs and religion -Uses of Ethical theories.

UNIT - II

HUMAN VALUES

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning - Civic Virtue – Respect for Others –Living Peacefully – Caring – Sharing - Honesty – Courage– Valuing Time - Cooperation – Commitment – Empathy – Self Confidence – Character – Spirituality

UNIT – III

ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as experimentation - Engineering Projects VS. Standard Experiments - Engineers as responsible experimenters – Codes of ethics - Industrial Standards - A balanced outlook on law- The challenger case study.

UNIT - IV

SAFETY, RESPONSIBILITIES AND RIGHTS

Safety and risk- Assessment of safety and risk- Risk benefit analysis and reducing risk- Three Mile Island and Chernobyl case study - Collegiality and loyalty -Respect for authority - Collective bargaining – Confidentiality- Conflicts of interest- Occupational crime - Professional Rights- Employee rights- Intellectual Property Rights (IPR) discrimination.

UNIT - V

GLOBAL ISSUES

Multinational Corporation's -Environmental ethics-computer ethics -weapons development Engineers as managers - consulting engineers-engineers as expert witnesses and advisors Moral leadership - sample code of Ethics (Specific to a particular Engineering Discipline).

TEXT BOOKS

1. R.S.Nagarajan, a Textbook on "Professional Ethics and Human Values", New Age Publishers – 2006.
2. Mike Martin and Roland Schinzinger, "Ethics in engineering", McGraw Hill, New York 1996.

REFERENCES

1. Govindarajan M, Natarajan S, Senthil Kumar V. S, " Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
2. Charles D. Fleddermann, "Engineering Ethics", Pearson Education/ Prentice Hall, New Jersey,2004 (Indian Reprint now available)
3. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available).
4. John R Boatright, "Ethics and the conduct of business", Pearson Education, New Delhi,2003.
5. Edmund G Seebauer and Robert L Barry, "Fundamentals of ethics for scientists and engineers", Oxford University Press, Oxford, 2001.

IV SEMESTER

L146 - FLUID MECHANICS AND HYDRAULIC MACHINERY LAB

(Common to CE, ME)

Prerequisite Subject: Fluid Mechanics and Hydraulic Machinery

Course Educational Objectives:

1. To learn the fundamental physical and analytical principles of fluid mechanics

2. To learn the essence of conservation of mass, conservation of energy, and the conservation of momentum equations in fluid mechanics while doing experiments.

3. To learn the concepts of Bernoulli's theorem, conservation principles, ideal incompressible flow, and flow of a real fluid practically.

4. To learn the concepts of impulse-momentum equation applied to jets, functioning and performance of hydraulic turbines.

Course Outcomes:

After completion of the course student will be able to:

1. Apply basic principles, governing equations and the dynamics of non-viscous fluids
2. Apply the Bernoulli equation to solve problems in fluid mechanics, and application on control volume analysis problems in fluid mechanics.
3. Apply the laminar and turbulent boundary layer fundamentals in fluid flow problems.
4. Develop the capability to apply conservation principles to turbo machines i.e., in hydraulic turbines.

LIST OF EXPERIMENTS

At least 10 Experiments are required to be conducted

1. Verification of Bernoulli's Theorem
2. Calibration of Venturi meter
3. Calibration of Orifice meter.
4. Determination of friction factor for a given pipe line
5. Determination of loss of head due to sudden contraction in a pipeline
6. Impact of jets on Vanes.
7. Performance Test on Pelton Wheel.
8. Performance Test on Kaplan Turbine.
9. Performance Test on Single Stage Centrifugal Pump.
10. Performance Test on Multi Stage Centrifugal Pump.
11. Performance Test on Reciprocating Pump.
12. Turbine flow meter.
13. Calibration of low speed wind tunnel.
14. Reynolds experiment.
15. Potential Flow Study Using Hele-Shaw Apparatus
16. Flow Visualization study using Water Flow Channel

REFERENCES

Lab Manuals

IV SEMESTER

L172 - PRODUCTION TECHNOLOGY AND MODELLINGLAB

Prerequisite Subject: Production Technology

PART-A

Course Educational Objectives:

The objectives of the course are to

1. Provide hands-on laboratory experience in the area of production.
2. Provide basic knowledge about casting and tools used in casting.
3. Get familiarize with welding equipment and various welding processes.
4. Acquire practical knowledge in mechanical press working.
5. Get equip with injection moulding.

Course Outcomes:

After completion of the course students are able to:

1. Apply the principles of production technology in manufacturing industries.
2. Choose a suitable production process for a product.

At least 10 Experiments should be conducted from **PART A & PART B**.

PART A : PRODUCTION TECHNOLOGY

I. METAL CASTING LAB

1. Pattern Design and making - for one casting drawing – 1 Exercise.
2. Sand properties testing - Exercise -for strengths, and Permeability - 1 Exercise.
3. Moulding, Melting and Casting - 1 Exercise

II WELDING LAB

1. ARC Welding Lap & Butt Joint - 2 Exercises.
2. Spot Welding - 2 Exercises.
3. TIG Welding - 1 Exercise.

III MECHANICAL PRESS WORKING

1. Blanking & Piercing operation and study of simple, compound and progressive press tool.
2. Hydraulic Press: Deep drawing and extrusion operation.
3. Bending and other operations

IV PROCESSING OF PLASTICS

1. Injection Moulding

PART-B :MODELLING LAB

1. Introduction to a modelling package:

Protrusion – cut – sweep – revolve-Draft and Loft-Modify/edit-Pattern-Transformation-Boolean operations.

2. PartModeling:(Two examples)
   Generation of various 3D models through protrusion, revolve, shell, sweep etc. Creation of various features
3. Assemblymodeling of machine parts.(Two examples)
   Ex: knuckle joint, universal joint, IC engine piston and rod end assembly etc
4. Wireframe modelling (One example)
5. Surface modelling (One example)

SOFTWARE PACKAGES

ProE /CATIA / Unigraphics.

REFERENCES

Lab Manuals

V SEMESTER

S267 - IC ENGINES AND GAS TURBINES

Prerequisite Subject: Thermodynamics

Course Education Objectives:

1. To understand the engine terminology and working principles of I.C Engines.
2. To learn analytical techniques to the engineering problems and performance analysis of internal combustion engines.
3. To learn the design and operating characteristics of modern internal combustion engines.
4. To know the environmental and fuel economy challenges facing the internal combustion engine.
5. To understand the gas turbine and jet propulsion and rocket theory.

Course Outcomes:

After completion of the course students are able to :

1. Differentiate among different internal combustion engine designs.
2. Recognize and understand reasons for differences among operating characteristics of different engine types and designs.
3. Develop skills to run engine and do experiments and validate the theoretical results.
4. Develop an ability to optimize engine designs for specific sets of constraints.
5. Identify and apply the concepts of gas turbines for power generation& aviation purpose.

UNIT - I

INTRODUCTION: Heat engine, Classification of IC Engines, Basic Engine Components and Nomenclature, Working principles of 4-Stroke and 2-Stroke Spark Ignition and Compression Ignition Engines, Valve and Port timing diagrams, Applications of I.C.Engines.

ENGINE SYSTEMS: Introduction, Layout of Fuel supply system for SI Engine-Simple Carburettor, Fuel supply system for CI Engine-Solid Injection-Individual pump type-Common rail type only.

UNIT - II

ENGINE SYSTEMS: Cooling systems, Air cooling, Water cooling, Comparison, Radiators and cooling fans, Lubricating systems, Mist lubrication, Wet sump lubrication, and Dry sump lubrication system, Ignition systems, Battery, Magneto and Electronic ignition system.

AIR-STANDARD CYCLES AND THEIR ANALYSIS: Introduction, Carnot, Otto, Diesel, Dual, Atkinson , Stirling , Ericson and Brayton cycles.

FUEL-AIR CYCLES AND THEIR ANALYSIS: Introduction, Fuel-air cycles and their significance, composition of cylinder gases, dissociation, comparison of air-standard and fuel-air cycles.

ACTUAL CYCLES AND THEIR ANALYSIS: Introduction, comparison of air-standard and actual cycles, time loss factor, heat loss factor, exhaust blow down, loss due to rubbing friction, actual and fuel-air cycles of engines.

UNIT - III

COMBUSTION IN SI ENGINES: Introduction, Homogeneous and Heterogeneous mixture, stages of combustion in SI engines, flame front propagation, factors influencing the flame speed, Abnormal combustion, phenomenon of knock in SI engines, effect of engine variables on knock, combustion chambers for SI engines- Fuel requirement and fuel rating.

COMBUSTION IN CI ENGINES: Introduction, stages of combustion in CI engines, factors affecting the delay period, phenomenon of knock in CI engines, comparison of knock in SI and CI engines, Combustion Chambers for CI engines, Fuel requirement and fuel rating.

UNIT - IV

ENGINE TESTING AND PERFORMANCE: Introduction,Parameters of performance-Measurement of Fuel consumption, Air intake, Brake power, Determination of Frictional power and Indicated power, Performance tests, Performance Characteristic Curves, Heat Balance sheet.

UNIT - V

GAS TURBINES: Introduction, Gas turbine plant and Its Components, Classification, Analysis of Closed and Open cycle Gas Turbine plants-Methods of improving performance-Intercooler, Regeneration and Reheating, Applications.

JET PROPULSION SYSTEMS: Introduction-Qualitative treatment of Turbojet, Turbo Fan, Turboprop, Ramjet, applications.

TEXT BOOKS

1. V.Ganesan, Internal Combustion Engines – Tata McGraw-Hill, 3rd Edition 2008 Edition.
2. V.Ganesan, Gas Turbines – Tata McGraw-Hill, 2007 Edition.
3. P.W.Gill ,J.H.Smith&Ziurys ,Fundamentals of I.C.Engines - IBH & Oxford publications, 4th Edition 1959.

REFERENCES

1. John B.Heywwod, Internal Combustion Engine Fundamentals ,Tata McGraw-Hill,2012.
2. M.L.Mathur&R.P.Sharma, A Course in I.C. Engines ,DhanpatRai New Delhi, 7th Edition 2000.
3. Cohen ,Rogers and Sarvanamuttu, Gas Turbine Theory, Longman Group limited, England,4th Edition 1996.
4. Vasandhani& Kumar, Treatise on Heat Engineering - Metropolitan Book Company, Delhi,4th Edition 2001.
5. Pulkrabek, Engineering Fundamentals of I.C.Engines – PHI 2nd Edition 2004.

V SEMESTER

S291 - MACHINE DESIGN - I

Prerequisite Subject: Kinematics of Machines

Course Educational Objectives: The objectives of this course are

1. To illustrate the integration of design principles, materials selection and fundamentals of design concepts.
2. To study the effects of stress concentration in various machine elements
3. To understand threaded fasteners, welded connections and rived joints with respect to axial and eccentric loads.
4. To understand various joints subjected to axial loading
5. To apply various theories for the design of shafts subject to combined static and dynamic load and familiarize with the shaft couplings

Course Outcomes:

At the end of this course students will be able to

1. Formulate and analyze stresses and strains in machine elements and structures subjected to different loads.
2. Evaluate the stress distribution and analyze the failure criterion of mechanical parts under static and fatigue loads
3. Design temporary and permanent joints.
4. Analyze and design power transmission shafts supporting various elements in industry
5. Design shaft couplings for various engineering applications.

UNIT – I

INTRODUCTION: Basic procedure of machine design– Basic requirements of machine elements – Design of machine elements – Design analysis-Design synthesis – Introduction to Indian standards-Selection of Preferred sizes

DESIGN FOR STATIC STRENGTH: Modes of failure – Factor of safety – Stress-strain relationship – Shear stress and shear strain – Stresses due to bending moment – Stresses due to torsional moment – Eccentric axial loading - Theories of elastic failure-Maximum principal stress theory-Maximum shear stress theory-Distortion energy theory

UNIT – II

DESIGN FOR FATIGUE STRENGTH: Stress concentration – Stress concentration factors - Reduction of stress concentration- Fluctuating stresses – Fatigue failure – Endurance limit – Notch sensitivity - Endurance limit - Approximate estimation – Soderberg and Goodman lines – Design for infinite life

UNIT – III

RIVETED JOINTS: Types of riveted joints - efficiency of riveted joint - eccentrically loaded riveted joints

WELDED JOINTS: Butt joints-Fillet joints-Strength of butt welds - Strength of parallel fillet welds-Strength of transverse fillet welds-Maximum shear stress in parallel fillet and transverse fillet welds-Axially loaded unsymmetrical welded joints-Welded joint subjected to bending moment

UNIT – IV

THREADED JOINTS: Threaded joints-Terminology of screw threads- Bolted joint - Eccentrically loaded bolted joints in shear - Eccentric load perpendicular to axis of bolt - Bolts of uniform strength

KEYS, COTTER AND KNUCKLE JOINTS: Types of keys- Design of square and flat keys-Cotter joints-Socket and Spigot cotter joint-Knuckle joint-Failures

UNIT – V

SHAFTS: Transmission shafts-Shaft design on strength basis-Shaft design on torsional rigidity basis-ASME code for shaft design-Design of hollow shaft on strength and torsional rigidity basis

SHAFT COUPLINGS: Requirements – Rigid couplings-Muff coupling-Clamp coupling-Flange coupling-Bushed pin flexible coupling

TEXT BOOKS

1. Bhandari V.B, Design of Machine Elements, 3rd Edition, 2nd Reprint, Tata McGraw-Hill 2010
2. Shigley J.E and Mischke C. R., Mechanical Engineering Design, 6th Edition, Tata McGraw-Hill, 2003.

REFERENCES

1. Norton R.L, "Design of Machinery", ,2nd edition,Tata McGraw-Hill Book Co, 2001.
2. Orthwein W, "Machine Component Design", 1st edition, Jaico Publishing Co, 1999.
3. Ugural A.C, "Mechanical Design – An Integral Approach, McGraw-Hill Book Co, 2004.
4. Spotts M.F., Shoup T.E "Design and Machine Elements" Pearson Education, 2004.
5. Juvinall R. C., Marshek K.M., "Fundamentals of Machine component Design", – John Wiley & Sons 3rd Edition, 2002.

V SEMESTER

S203 - DYNAMICS OF MACHINES

Prerequisite Subject: Kinematics of Machines

Course Educational Objectives:

The main objective of this course is to

1. Understand the effect of frictional force on clutches and brakes under various conditions.
2. Gain the knowledge of kinematic synthesis and dynamics of different applications of gyroscopic and precessional motion
3. Understand the concept of energy stored in the fly wheels and speed regulations of various governors
4. Understand the concepts of static and dynamic mass balancing of rotating and reciprocating masses to minimize vibrations and noise.
5. Understand the concepts of free and damped vibrations

Course Outcomes:

After completion of the course students are able to:

1. Solve the practical problems on clutches and brakes under various conditions.
2. Recognize the needs of various principles of dynamics of machines and apply to practical situations
3. Analyze the energy storage in the flywheels and speed regulations of various Governors
4. Balance the unbalanced forces developed in the rotating and reciprocating masses.
5. Analyze the concepts of vibrations & take measures to minimize vibration and noise

UNIT - I

CLUTCHES, BRAKES AND DYNAMOMETERS: Friction clutches- Single plate clutch- Multiple plate clutch- Cone clutch-Centrifugal Clutch - Block brake- Band brake - Block & band brake - Internal expanding shoe brake- Dynamometers – Absorption and Transmission types- General description and method of operations

PRECESSION: Gyroscopes- Effect of precession – Aeroplanes and Ships - Motion on the stability of moving vehicles - Motor car and Motor cycle

UNIT - II

TURNING MOMENT DIAGRAMS AND FLY WHEELS: Turning moment – Angular velocity and acceleration of connecting rod – Crank effort and torque diagrams - Inertia torque of connecting rod - Fluctuation of energy – Fly wheels and their design.

UNIT - III

GOVERNORS: Watt, Porter and Proell governors- Spring loaded governors - Hartnell governor- Sensitiveness- Isochronism - Hunting.

UNIT - IV

BALANCING : Introduction – Balancing of Rotating Masses – Single and Multiple – Single and different planes - Primary and Secondary balancing of reciprocating masses -Analytical method - Unbalanced forces and couples - Locomotive balancing – Hammer blow- Variation of Tractive efforts - Swaying couple

UNIT - V

VIBRATIONS: Types of vibrations-Degrees of freedom-Free longitudinal vibrations-Displacement, velocity and acceleration-Inertia effect of the mass of spring-Damped vibrations- Forced vibrations- Forced damped vibrations-Vibration isolation and transmissibility-Whirling of shafts

TEXT BOOK

1. Rattan S.S, “Theory of Machines”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007
2. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw-Hill, Inc., 1995.

REFERENCES

1. Rao J.S and Dukkipati R.V, “Mechanism and Machine Theory”, New Age International, NewDelhi, 2007.
2. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
3. Sadhu Singh “Theory of Machines”, Pearson Education, 2002.
4. Ballaney.P.L ”Theory of Machines”, Khanna Publishers,1990.
5. Ghosh A. and Mallick A.K., "Theory of Mechanisms and Machines", Affiliated East-West Press Pvt. Ltd., New Delhi, 1988.

V SEMESTER

S270 - INDUSTRIAL MANAGEMENT

(Common to CSE, ECE, EEE, EIE, IT, ME

Prerequisite: None

Course Educational Objectives (CEOs):

In this course student will learn about

1. The fundamental concepts and contributions of Management.
2. Human Resource Practices, Quality controls and Project Management which plays a vital role in the organization.
3. Study techniques for increased productivity.
4. Human Resource Management practices.
5. Various network analysis techniques.

Course Outcomes:

After completion of the course, students will be able to

1. Apply the conceptual knowledge of management and organization in work environment.
2. Take decisions relating to location of plant and layout of plant.
3. Conduct work study techniques for increased productivity and also able to control quality of products.
4. Manage human resources efficiently and effectively with best HR practices.
5. Plan and control projects through network analysis techniques.

UNIT - I

INTRODUCTION: Management - Definition, Nature, Importance of management Functions of Management - Taylor's scientific management theory, Fayal's principles of management, Contribution of Elton mayo, Maslow, Herzberg, Douglas MC Gregor, basic concepts of Organisation- Authority, Responsibility Delegation of Authority, Span of control, Departmentation and Decentralization - Organisation structures (Line organization, Line and staff organization, Functional organization, Committee organization, Matrix organization)

UNIT - II

OPERATIONS MANAGEMENT: Plant location, Factors influencing location, Principles and types of plant layouts - Methods of production (job, batch and mass production), Work study - Basic procedure involved in method study and Work measurement

UNIT - III

QUALITY AND MATERIALS MANAGEMENT: Statistical quality control – Meaning-Variables and attributes - X chart, R Chart, C Chart, P Chart, (simple Problems) Acceptance sampling, Sampling plans, Deming's contribution to quality. Materials management – objectives, Need for inventory control, Purchase procedure, Store records, EOQ, ABC analysis, Stock levels

UNIT - IV

HUMAN RESOURCE MANAGEMENT (HRM): Concepts of HRM, Basic functions of HR manager: Man power planning, Recruitment, Selection, Training and development, Placement, Wage and salary administration, Promotion, Transfers Separation, performance appraisal, Job evaluation and merit rating.

UNIT - V

PROJECT MANAGEMENT: Early techniques in project management - Network analysis: Programme evaluation and review technique (PERT), Critical path method (CPM), Identifying critical path, Probability of completing project within given time, Project cost analysis, project crashing (simple problems)

TEXT BOOKS

Dr.A.R.Aryasri, Management Science, TMH, 4thEdition, 2009

REFERENCES

1. Koontz &weihrich – Essentials of management, TMH, 8thEdition, 2010
2. Stoner, Freeman, Gilbert, Management, 6th edition Pearson education, New Delhi, 2004
3. O.P. Khana, Industrial engineering and ManagementL.S.Srinath, PERT & CPM

V SEMESTER

S308 - METAL CUTTING AND MACHINE TOOLS

Prerequisite Subject: Production Technology

Course Educational Objectives:

The main objectives of the course are to

1. Understand the concepts of metal cutting theory and single point cutting tool.
2. Get familiarize with operations performed on lathe.
3. Understand the principles of shaping, drilling, planning, boring machines and their operations
4. Study the concepts of milling machines and their operations.
5. Understand the concepts of finishing operations like grinding, lapping, honing and broaching

Course Outcomes:

After completion of the course student will be able to:

1. Apply the knowledge of various machine tools in development of a product.
2. Decide proper machining processes for components
3. Schedule job operations in chronological sequence in which parts would be produced in manufacturing in an industry.
4. Apply the knowledge of work holders, tool holders, hand tools and jigs and fixtures in manufacturing industries.

UNIT - I

ELEMENTARY TREATMENT OF METAL CUTTING THEORY: Elements of cutting process – Methods of Metal Cutting – Classification of Cutting Tools- Geometry of Single Point Cutting Tool. Chip formation, mechanism and types of chips- chip breakers. Merchant's Force diagram, measurement of cutting forces, work done in cutting. Metal cutting theories. Machining parameters-Tool Life, Tool Failure-Cutting Tool Materials, Cutting Fluids

UNIT - II

ENGINE LATHE: Principle of working and specification of lathe – Types of lathes – Work holders and tool holders –Lathe accessories- Operations on Lathe- -Taper turning-Thread turning and lathe attachments.

TURRET AND CAPSTAN LATHES: Principle of working -Collet chucks – Other work and tool holding devices – Box and tool layout.

UNIT - III

SHAPING, SLOTTING AND PLANING MACHINES: Principles of working – Principal parts –Specification, classification, operations performed, machining time calculations.

DRILLING AND BORING MACHINES: Principles of working, specifications, types, operations performed – tool holding devices – twist drill – Boring machines – Fine boring machines – Jig Boring machine. Deep hole drilling machine.

UNIT - IV

MILLING MACHINES:– Principle of working – Specifications – Classifications of milling machines – Principal features of horizontal, vertical and universal milling machines – Machining operations-Types -Geometry of milling cutters –Milling cutters – Methods of indexing – Accessories to milling machines.

GRINDING MACHINES– Fundamentals – Theory of grinding –Classification of grinding machine – Cylindrical and surface grinding machine – Tool and cutter grinding machine – special types of grinding machines.

UNIT - V

LAPPING, HONING AND BROACHING MACHINES: Comparison to grinding – lapping and honing. Constructional features of speed and feed units, machining time calculations

JIGS AND FIXTURES: Principles of design of Jigs and fixtures and uses. Classification of Jigs & Fixtures – Principles of location and clamping – Types of clamping & work holding devices. Typical examples of jigs and fixtures.

TEXT BOOK

1. R.K. Jain and S.C. Gupta, Production Technology, Khanna publication, 17th Edition, 2012**.**

2. H.M.T. (Hindustan Machine Tools), Production Technology, Tata MeGraw Hill, 2009.

REFERENCES

1. B.S.RaghuVamshi ,Workshop Technology, DhanpatRai& Co, 10th edition, 2009.
2. Gosh and Malik , Manufacturing Science, East west press Pv.t Ltd., 2ndEdition, 2011.
3. Kalpakjain S, Manufacturing Engineering & Technology, Pearson Education, 4thEdition 2001.
4. J.P.Kaushish, Manufacturing Processes, PHI, 2ndEdition, 2010.

V SEMESTER

S329 - OPERATIONS RESEARCH

(Common to AE, CSE, IT, ME)

Prerequisite Subject: Estimation, Costing and Engineering Economics

Course Educational Objectives:

The objective of this course is to:

1. Underline the applications of operations research techniques in Industries.
2. Discuss the difference between deterministic and stochastic models.
3. Familiarize the concepts of simulation and dynamic programming.
4. Describe the concept of feasible region, optimal solution.
5. Illustrate the applications of Transportation and Assignment models.

Course Outcomes:

After completion of the course student will be able to:

1. Develop mathematical models for real engineering problems.
2. Demonstrate the familiarity in identifying the key parameters influencing the production cost.
3. Exhibit knowledge in solving inventory control problems.
4. Choose optimal strategy using OR techniques.

UNIT - I

INTRODUCTION: Operations Research, operations research models, applications, Linear Programming Problem Formulation, Graphical solution, Simplex method, Two Phase simplex

UNIT - II

TRANSPORTATION PROBLEM: Formulation, Optimal solution, unbalanced transportation problem, Degeneracy. Assignment problem, optimal solution, Variants of Assignment Problem-Traveling Salesman problem.

UNIT - III

THEORY OF GAMES: Minimax (maximin) Criterion and optimal strategy, Solution of games with saddle points, Rectangular games without saddle points, 2 X 2 games – dominance principle – m X 2 & 2 X n games, and graphical method.

INVENTORY CONTROL: EOQ model, Shortages not allowed, Deterministic models, Probabilistic models, Price breaks

UNIT - IV

THEORY OF REPLACEMENT: Introduction, Replacement of Equipment that Deteriorates Gradually, Replacement of Equipment that fails suddenly, Group Replacement.

WAITING LINES: Single Channel – Poisson arrivals – exponential service times – with infinite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals.

UNIT - V

DYNAMIC PROGRAMMING: Bellman's Principle of optimality, Applications of dynamic programming, capital budgeting problem, linear programming problem.

INTRODUCTIONTOOPTIMIZATION: Introduction, Engineering Applications of Optimization, Problem Statement – Design Vector, Design Constraints, Constraint surface, Objective function, Objective function Surfaces. Classification of optimization problems, Optimization Techniques – Introduction, Single-variableOptimization.

TEXT BOOKS

1. Kantiswarup. P.K.Gupta, Man Mohan, Operations Research, Sultan Chand& Sons, Educational Publications, New Delhi, 14th Edition, 2008.
2. Hiller &Libermann, Introduction to O.R (TMH), 9thEdition, 2009

REFERENCES

1. Singiresu S Rao, Engineering Optimization: Theory and Practice, A Wiley-Interscience Publication, 4th edition,2009.
2. A.M.Natarajan, P.Balasubramani, A. Tamilarasi,Operations Research, Pearson Education, 2nd edition, 2014.
3. Taha, Introduction to O.R .PHI, 9th edition, 2010.

V SEMESTER

L156 - MACHINE TOOLS AND DYNAMICS LAB

Course Educational Objectives:

The objectives of the course are to

1. Understand the various machining processes.
2. Familiarize with the tools used in machine shop.
3. Understand basic operations of lathe, milling, drilling, shaping and planning machines.
4. Study the static and dynamic behavior of Mechanisms & Machines.
5. To know the kinematic concepts of mechanisms such as cams, governors, gyroscopes etc
6. Understand the concepts of vibrations.

Course Outcomes:

After completion of the course students are able to:

1. Exhibit the ability in developing sequence of machining operations required for in industry.
2. Capable of manufacturing components according to given working drawings
3. Apply the knowledge of cams, governors, gyroscopes in developing machines.
4. Overcome the typical problems faced by engineers in industries.

MACHINE TOOLS

PART-A

LIST OF EXPERIMENTS :

1. Introduction to Lathe.
2. Step turning and taper turning on lathe machine
3. Thread cutting and knurling on -lathe machine.
4. Drilling and Tapping
5. Shaping and Planning
6. Slotting
7. Milling
8. Grinding of Tool angles

PART-B

DYNAMICS LAB LIST OF EXPERIMENTS

Any of the 6 Experiments are required to be conducted

1.a) To determine gyroscopic couple on Motorized Gyroscope
   b) Determination of transmission efficiency of gear reducers
2.a) To find the stability and sensitivity of Watt governor
   b) To find the stability and sensitivity of Porter governor
3. To find the transverse vibrations of free-free beam
4.a) Balancing of rotating masses
   b) Balancing of reciprocating masses
5. Determination of damping coefficient of single degree of freedom system using spring mass system
6. Determination of critical speed of shaft with concentration loads
7.a) Determine the moment of inertial of connecting rod by compound pendulum method
   b) Determine the moment of inertial of flywheel by oscillation

STUDY EXPERIMENTS:

1. To study various types of cam and follower mechanisms
2. To study inversions of four bar mechanisms, single and double slider crank mechanisms
3. To study various types of gear trains- simple, compound, reverted, epicyclic and differential.
4. To study the working of screw jack and determine its efficiency

REFERENCES

Lab Manual

V SEMESTER

L181 - THERMAL ENGINEERING LAB

Prerequisite Subject: THERMAL ENGINEERING

Course Education Objectives:

1. To learn the construction and working principle of I.C.Engines practically.
2. To understand the working principle and performance of air compressor practically.
3. To learn the heat balance test of an I.C. Engine.
4. To acquire the priorities given to the efficient use of energy and the minimization of environmental pollution.
5. To understand the usage of data acquisition systems.
6. To learn the concepts of Psychrometry terms

Course Outcomes:

After completion of the course students are able to:

1. Find the efficiency and performance of an engine system for a given set of conditions.
2. Analyze the Volumetric efficiency of air compressor.
3. Develop skills in data acquisition systems.
4. Evaluate the engine performance and explore the ways to improve the efficiency of engines.
5. Realize the need to minimize the losses in engines.
6. Realize the need for developing the less polluting engines by adopting alternate fuels and engine modifications.

LIST OF EXPERIMENTS

At least 10 Experiments are required to be conducted

1. I.C. Engines Valve & Port Timing Diagrams
2. Performance Test on Variable Compression Ratio single cylinder 4-Stroke petrol Engine By using Eddy Current Dynamometer
3. Performance Test on single cylinder 4 -Stroke Diesel Engine by using Mechanical Dynamometer
4. Performance test on twin cylinder 4-stroke diesel engine.
5. Performance Test on single cylinder 2-Stroke Petrol Engine.
6. Evaluation of Engine friction power by conducting Morse test on Multi cylinder 4-Stroke Petrol Engine.
7. Evaluation of Engine friction by conducting Retardation test on 4-stroke Diesel Engine.
8. I.C. Engine Heat Balance.
9. Performance test on PC based diesel Engine test rig.
10. Measurement of pollutants and smoke of I.C Engine.
11. Performance Test on Reciprocating Air – Compressor.
12. Performance Test on Vapour Compression Refrigeration Unit.
13. Performance Test on Air Conditioning Unit.
14. Assembly / Disassembly of Engines.
15. Viscosity of lubricants by using Redwood/ Say bolt viscometer Apparatus
16. Flash and Fire Point of fuels by using pesky Martin Apparatus
17. Carbon Residue test
18. Determination of calorific value of fuel using calorimeter

REFERENCES

Lab Manual

VI SEMESTER

S259 - HEAT TRANSFER

Prerequisite Subject: Applied Mathematics- I, II, Thermodynamics, Thermal Engineering

Course Educational Objectives:

1. To learn the basic differential equations of heat transfer in conduction, convection and radiation.
2. To acquire the phenomenon of critical thickness of Insulation, Heat Transfer in Fins.
3. To understand the significance of Non Dimensional Numbers in Heat Transfer ,Natural and Forced Convection Mechanisms and correlations
4. To learn the basics of phase change processes of boiling and condensation in thermal systems and laws of radiation.
5. To learn about the LMTD, NTU concepts used in heat exchangers.

Course Outcomes:

After completion of the course students are able to:

1. Analyze the basic heat transfer concepts and their practical relevance in Planes, Cylinders and Spherical components.
2. To solve practical problems of steady and unsteady state heat transfer.
3. Develop skills to identify suitable Nusselt number empirical correlation for Planes, Cylinders.
4. To formulate the radiation heat exchange between two surfaces.
5. Design simple heat exchanger units of moderate capacity.

UNIT - I

INTRODUCTION: Basic Modes of Heat Transfer- Basic laws of Heat transfer-Applications of heat transfer- Steady, Unsteady and Periodic Heat Transfer- Heat conduction-Fourier's equation-Thermal conductivity-General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates and its simplification-Initial and boundary conditions.

ONE- DIMENSIONAL STEADY STATE CONDUCTION: Heat flow through plane wall and cylinder with constant thermal conductivity- Electrical analogy-Thermal resistance-Overall heat transfer coefficient-Applications-Heat flow through Composite Wall and Cylinder - Critical radius of insulation for Cylinder and Sphere-Applications.

UNIT - II

ONE DIMENSIONAL STEADY STATE CONDUCTION: Heat flow through plane wall and cylinder with Variable Thermal conductivity - Uniform internal heat generation in Slabs-Extended Surfaces- Analysis of Long Fin and Short fin with insulated tip - Fin efficiency and Effectiveness-Applications.

ONE DIMENSIONAL TRANSIENT HEAT CONDUCTION: Systems with negligible internal resistance-Lumped Heat analysis–Significance of Biot and Fourier Numbers-Plane wall with finite surface and internal resistance using Heisler Chart-Applications.

UNIT - III

DIMENSIONAL ANALYSIS: Introduction- Dimensional analysis -Buckingham Pi Theorem applied to Forced convection --Significance of Non Dimensional numbers-The boundary layer concept-The velocity and Thermal boundary layers -application

FORCED CONVECTION: Introduction, applications- –convective heat transfer coefficient-External Flow-Laminar and TurbulentFlow over a Flat plate –Internal Flow through Circular pipe-Laminar and Turbulent Flows-Entry length and fully developed flow - Reynolds Colburn analogy-application.

NATURAL CONVECTION: Introduction, applications-Development of Hydrodynamic and thermal boundary layer along Vertical plate- Empirical correlations for Vertical plate, Vertical Cylinder, Horizontal Plate and Horizontal Cylinder.

UNIT - IV

BOILING AND CONDENSATION: Applications ofBoiling Heat transfer phenomena-Pool Boiling- Boiling regimes- Critical Heat Flux-Condensation-Film wise and Drop wise condensation- Laminar film wise condensation on Vertical plate.

THERMAL RADIATION: Introduction-Applications of Thermal Radiation-Nature of Thermal radiation-Emissive power-Absorption, Reflection and Transmission-Concept of Black body –Laws of Black Body Radiation- Radiation from Non black surfaces-Emissivity-Kirchhoff's law –Radiation heat exchange between two black isothermal surfaces- shape factor- Heat exchange between non black infinite parallel plates- Radiation shields.

UNIT - V

HEAT EXCHANGERS: Introduction-Classification of heat exchangers -Flow arrangement, Temperature distribution- Overall heat transfer coefficient- Fouling factor- LMTD method of Heat exchanger analysis-Correction for LMTD for use with Multi pass and Cross flow Heat Exchangers, Effectiveness - NTU method of Heat Exchanger analysis-Applications of Heat Exchangers.

DATA HAND BOOK

C.P. Kothandaraman and Subramanian Heat and Mass Transfer Data Book, New Age International Publications, 7th Edition, Reprint 2012

NOTE: Heat and Mass Transfer Data Hand Book by C.P. Kothandaraman and Subramanian- New Age Publications is to be allowed in Examination.

TEXT BOOKS:

1. R.C.Sachdeva -Fundamentals of Engineering Heat and Mass Transfer —New Age Intl. Publishers 2nd Edition, 2005
2. Yunus. A. Cengel, Heat & Mass Transfer-A Practical Approach – Tata McGraw Hill, 4th Edition, 2012

REFERENCES

1. J.P.Holman, Heat transfer - Tata McGraw-Hill, 9th Edition, 2010
2. P.K.Nag, Heat and Mass Transfer- TMH 2nd Edition, 2007
3. P.S.Ghoshdastidar Heat Transfer - Oxford Higher Education 6th Edition 2011.
4. C.P.Kothandaraman and Subramanian, Heat and Mass Transfer, New Age International Publications 7th Edition 2010.

VI SEMESTER

S292 - MACHINE DESIGN-II

Prerequisite Subject: Machine Design –I

Course Educational Objectives: The objectives of this course are

1. To understand the hydrodynamic lubrication in bearings
2. To understand the concepts related to journal bearings and rolling contact bearings
3. To understand the design considerations of the engine components.
4. To gain the knowledge on the principles and procedure for the design of power transmission elements
5. To understand the gears with respect to tooth bending strength and surface strength specifications and fatigue consideration

Course Outcomes: At the end of this course students will be able to

1. Design hydrodynamic journal bearings and evaluate the life of the antifriction bearings
2. Design the internal combustion engine components for safe and continuous operation
3. Select the wire ropes for elevators, cranes and hoisting machinery
4. Design the springs with respect to static and dynamic loads
5. Apply the design concepts to evaluate the strength of the gear
6. Design the gear box for machine tools and automobiles

UNIT - I

SLIDING CONTACT BEARINGS: Types of Journal bearings –Theory of lubrication – Bearing modulus – Full, partial and fitted journal bearings –Heat generation and heat dissipation of bearings- Bearing materials – Journal bearing design

ROLLING CONTACT BEARINGS: Ball and roller bearings – Static load carrying capacity – Dynamic load carrying capacity – Equivalent bearing load – Selection of bearing life – Design for cyclic loads and speeds

UNIT – II

PISTON: Forces acting on piston – Construction – Design and proportions of piston

CONNECTING ROD: Thrust in connecting rod –Rankine's formula - Stress due to whipping action on connecting rod ends

CRANK SHAFT: Strength and proportions of center crank shaft– Crank pins

CYLINDER: Design and proportions of Cylinder- Cylinder liners.

UNIT - III

PULLEYS: Flat belt pulleys – Materials –Design of pulleys for flat belt drive- V- belts – Designation – Design of V-grooved pulley.

WIRE ROPES: Introduction- Construction- Designation of wire ropes – Classification – Selection of wire rope – Stresses in hoisting ropes.

UNIT - IV

SPRINGS: Terminology – Styles of end - Stress and deflection equations- Spring materials - Surge in springs - Design of helical compression springs – Springs against fluctuating load - Energy storage capacity – Helical Torsion springs -Concentric springs- Leaf springs.

UNIT - V

SPUR & HELICAL GEARS: Spur gears- Helical gears –Lewis equation - Beam strength of gear tooth – Design analysis of spur gears – Estimation of centre distance, module and face width- Check for dynamic and wear considerations.

GEAR BOX: Introduction – Functions – Progression ratio – Speed diagram – Kinematic arrangement – Design of gear box

TEXT BOOKS

1. Bhandari V.B, Design of Machine Elements, 3rd Edition, Tata McGraw-Hill 2010
2. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", AnuradhaPublications, Chennai, 2003.

REFERENCES

1. Norton R.L, "Design of Machinery", Tata McGraw-Hill Book Co, 2004.
2. Shigley J.E and Mischke C. R., "Mechanical Engineering Design", Tata McGraw-Hill 2003
3. Ugural A.C, "Mechanical Design – An Integral Approach, McGraw-Hill Book Co, 2004.
4. Spotts M.F., Shoup T.E "Design and Machine Elements" Pearson Education, 2004.
5. Juvinall R. C., Marshek K.M., "Fundamentals of Machine component Design", – John Wiley & Sons 3rd Edition, 2002.

HAND BOOKS TO BE ALLOWED IN SEMESTER EXAMINATION:

1. P.S.G. College of Technology
2. Mahadevan

VI SEMESTER

S317 - MODERN MACHINING PROCESSES

Prerequisite Subject: Metal cutting & Machine Tools

Course Educational Objectives:

The objectives of the course are

1. To understand the concepts of various unconventional machining processes.
2. To familiarize the use of electrical energy in unconventional machining process.
3. Get acquitted with electrical discharge machining processes.
4. To understand basic concepts of Rapid Prototyping.
5. Familiarize with the various Rapid Prototyping Process.

Course Outcomes:

After completion of the course student will be able to :

1. Apply fundamental principles in machining special materials.
2. Solve most relevant industrial solutions pertaining to machining of hard materials.
3. Design soft tools for machining hard materials.
4. Apply the concepts of Rapid Prototyping to engineering objects
5. Analyze various Rapid Prototyping processes

UNIT - I

INTRODUCTION: Need for unconventional machining methods-Classification of unconventional machining processes – considerations in process selection.

MECHANICAL PROCESSES: Basic principle, equipment, process variable and applications of ultrasonic machining, abrasive jet machining and water jet machining.

UNIT - II

ELECTROCHEMICAL PROCESSES: Process, principles, equipment and material removal rate in electrochemical machining, electrochemical grinding, electrochemical deburring and electrochemical honing.

CHEMICAL MACHINING - principle- maskants –etchants- advantages and applications.

ELECTRICAL DISCHARGE MACHINING: General Principle and applications of Electric Discharge Machining– Power circuits for EDM, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids. Electric discharge wire cutting- principle and applications.

UNIT - III

ELECTRON BEAM, LASER BEAM AND PLASMA ARC MACHINING: Principle, process, equipment and applications of electron beam machining, laser beam machining, plasma arc machining and hot machining.

UNIT – IV

RAPID PROTOTYPING: Introduction, Prototype fundamentals, historical development, fundamentals of Rapid Prototyping, Advantages of Rapid Prototyping classification of Rapid prototyping. Rapid Prototyping process chain.

UNIT-V

LIQUID BASED RAPID PROTOTYPING: Stereo Lithography Apparatus (SLA), solid Ground Curing (SGC)Solid based Rapid Prototyping: Selective Laser Sintering (SLS), EOS's EOSINT Systems. Applications of Rapid Prototyping.

TEXT BOOKS

1. Pandey P.C. and Shah H.S, Modern Machining Process / TMH.
2. Chua C.K, Leong K.F and Lim C.S**,** Rapid Prototyping principles and applications, second edition, world scientific publishers.,2003.

REFERENCES

1. M.K.Singh, Unconventional Manufacturing Processes / New age international.
2. VK Jain, Advanced Machining Processes/ / Allied publishers.
3. N.Hopkinson, R.J.M Haque&P.M.DickensRapid Manufacturing, John wiley&Sons,2006.

VI SEMESTER

S372 – ROBOTICS

(Common to AE, ME)

Prerequisite Subject: Machine Design –I, II, KOM, DOM

Course Educational Objectives: To familiarize the students with

1. Basics of robots and various types of gripper
2. Rotation matrices and D-H representation
3. Fundamentals of robot dynamics
4. Path and trajectory planning of robots
5. various sensors used in robots and industrial applications of robots

Course Outcomes:

After completion of the course students are able to :

1. Apply robot fundamentals in designing various types of end effectors
2. Design the end effectors required for different applications.
3. Formulate D-H matrices for forward kinematics problems & Develop dynamic equations for robot dynamic problems.
4. Determine the robot trajectory to robotic motion & Basics of Robot Language
5. Select the sensors depending upon robotic application & its uses in various areas.

UNIT - I

INTRODUCTION : Basic concepts – Robot anatomy –Components of robots- Robot motions – Number of D.O.F – Work volume – Robot drive systems – Classification of robots by control method – Specifications of robots..

END EFFECTORS: Introduction – Types of end effectors – Mechanical grippers – Vacuum cups, magnetic grippers, adhesive gripers and others – Robot / End effectors interface – Considerations in gripper selection and design

UNIT - II

MANIPULATOR KINEMATICS: Introduction –Coordinate Frames, Description of Objects in space, Transformation of vectors, Inverting a Homogeneous Transform, Fundamental Rotation Matrices, Problems- D-H representation – problems on forward kinematics.

UNIT - III

DYNAMICS: Introduction -Differential transformations- jacobian – problems –, Lagrange Euler formulation , Problems

UNIT - IV

TRAJECTORY PLANNING: Introduction – considerations on trajectory planning – joint Interpolated trajectory – Cartesian path trajectory – problems

ROBOT PROGRAMMING :- Methods of robot programming – Lead through method.- Textual robot languages – Generations of programming languages – Robot language structure – Motion commands – End effector and sensor commands – VAL II programming language.

UNIT - V

ACTUATORS: Pneumatic, Hydraulic actuators, Servo motors, Stepper motors.

SENSORS: Position sensors: Potentiometers, resolvers, encoders – velocity sensors

ROBOT APPLICATION IN MANUFACTURING: Material transfer and machine loading/ unloading applications – Processing operations – Assembly and inspection – Future applications.

TEXT BOOKS

1. MikellP.Groover, Mitchell Weiss, Roger N. Nagel&Nicholas G. Odrey; Industrial Robotics, McGraw- HILL International Editions,1986
2. R.K.Mittal and IJ Nagrath, Robotics and Control ,Tata McGraw – Hill publishing company Limited, New Delhi,2003

REFERENCES

1. Robert J.Schilling, Fundamentals of robotics analysis & control, PHI learning private limited, New Delhi,4th Edition 2002
2. SaeedB.Niku, Introduction to robotics analysis systems Application, PHI learning private limited, New Delhi,2002
3. K.S.Fu, R.C Gonzalez and C.S.G.Lee, Robotics control, Sensing, vision, and intelligence; McGraw HILL International Editions,3rd Edition 2008

VI SEMESTER

S302 - MECHANICAL VIBRATIONS

Prerequisite Subject: Machine Design –I, II, DOM

Course Educational Objectives:

1. To enable the student to learn the process of reducing the physical systems (any number of degrees of freedom) to mathematical models
2. To enable the student to learn the process of formulating the equations with regards to mathematical models.
3. To enable the student to learn the process of finding the solutions and subsequently analyzing the physical systems for stability.
4. To enable the student to develop the concept of infinite number of degrees of freedom through practical examples.
5. To enable the student to learn the process of preparing corresponding electrical circuits for physical systems and apply the concepts of electrical and mechanical analogy to ascertain their stability

Course Outcomes:

At the end of this course each student will be able to

1. Learn how to develop mathematical models for mechanical systems using mass, spring and dampers.
2. Gain experience in deriving governing equations
3. Model a vibrating mechanical system, develop and solve its governing equations in order to obtain the response of the system under various types of excitation conditions
4. Learn how to interpret the response of a mechanical system and use the response information in its design and testing in both time and frequency domains
5. Understand the sources of vibration and noise in machines and make design modifications to reduce the vibration and noise and improve the life of the components for smooth operation

UNIT - I

UNDAMPED FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS: Introduction- Differential equation – Solution of differential equation - Torsional vibrations – Equivalent stiffness of spring combinations -Springs in series – Springs in parallel – Natural frequency of a vibration system by energy method.

UNIT - II

DAMPED FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS: Introduction – Different types of dampings – Free vibrations with viscous damping – Over damped, critically damped and under damped systems -Logarithmic decrement – Viscous dampers

UNIT - III

FORCED VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS: Introduction – Forced vibrations with constant harmonic excitation – Steady state vibrations – Forced vibration with rotating and reciprocating unbalance -Forced vibrations due to excitation of the support –Vibration isolation and transmissibility - Typical isolators and mount types – vibration measuring instruments

UNIT - IV

TWO DEGREES OF FREEDOM SYSTEMS: Introduction – Principal modes of vibrations – Other cases of simple two degrees of freedom systems – Two masses fixed on a tightly stretched string - Double pendulum – Torsional system – Undamped forced vibrations with harmonic excitation -Undamped dynamic vibration absorber

UNIT - V

MULTI DEGREE OF FREEDOM SYSTEMS: Exact analysis- Undamped free vibrations of a multi degree of freedom system – Influence coefficients – Flexibility coefficients and Maxwell reciprocal theorem – Torsional vibrations of multi rotor systems – Vibrations of geared systems - Numerical method – Determination of natural frequency of vibration by Rayleigh's method.

TEXT BOOKS

1. G.K.Grover, Mechanical vibrations,7th edition, Nemchand& Bros.2003.
2. W.T.Thomson, Theory of vibrations, 3rd edition, CBS Publications & Distributors,1999.

REFERENCES

1. William W.Setio, Mechanical vibrations, Schaum outline series, 1964.
2. V.P.Singh, Mechanical vibrations, 3rd edition, DhanpatRai& Sons, 2001.
3. S.S.Rao, Mechanical Vibrations, Pearson Education, 2004.

VI SEMESTER

S285 - JET AND ROCKET PROPULSION

Prerequisite Subject: Thermal Engineering, ICGT

Course Educational Objectives:

1. To learn the basics of air breathing engines and principles of jet propulsion.
2. To understand the working principles of combustors and nozzles used in aerodynamics.
3. To learn the different types of rocket propulsion systems.
4. To understand the Turbo machinery used for solid and liquid engines
5. To learn the fundamentals of solid and liquid propellants used in rockets.

Course Outcomes:

At the end of the course students are able to

1. Analyze the basic principles of air breathing engines and jet propulsion.
2. Acquires the knowledge on function, performance and efficiency of different combustors and nozzles used in rockets.
3. Analyze the performance of jet and rocket engines
4. Get acquainted with Turbo machinery used for solid and liquid engines
5. Identify the fundamental knowledge of solid and liquid propellants used in rockets

UNIT-I

PRINCIPLES OF JET PROPULSION: Introduction,Fundamentals of jet propulsion

AIR-BREATHING ENGINES: Introduction, Thermodynamics of Aircraft Jet Engines- Turbo jet, Turbo fan, Turbo prop, and Ramjet engines, Typical Engine Performance – Applications of Jet Propulsion.

UNIT-II

AEROTHERMODYNAMICS OF COMBUSTORS AND NOZZLES: Introduction, Subsonic Inlets, Supersonic Inlets, Gas Turbine Combustors, after burners and Ram jet Combustors, Supersonic Combustion, Exhaust Nozzles- Applications of combustors and nozzles.

UNIT-III

PERFORMANCE OF ROCKET VEHICLES: Introduction, Static Performance, Vehicle Acceleration, Gravity-Free Drag-Free Space Flight, Forces Acting on a Vehicle in the Atmosphere, Basic Relations of Motion, Space Flight, Flight Manoeuvres, Effect of Propulsion System on Vehicle Performance, Flight Vehicles, Military Missiles, Flight Stability, Chemical Rockets , Applications

UNIT-IV

LIQUID ENGINES

Propellant Feed systems and engine cycles (gas-pressure feed and turbo pump feed, gas-generator cycle, staged combustion, cycle, expander cycle, typical examples) – Centrifugal pumps – Inducers and axial pumps (inducers, Cavitation, axial pumps) – Axial turbines,Applications

ELECTRICAL ROCKET PROPULSION

Introduction – Electrostatic propellant accelerator – Bombardment ionization – The plane diode - Electrostatic thruster performance – The arc jet – Pulsed-magneto plasma accelerators, Applications

UNIT-V

LIQUID PROPELLANTS: Propellant Properties, Liquid Oxidizers, Liquid Fuels, Liquid Monopropellants, Gelled Propellants, Gaseous Propellants, Safety and Environmental Concerns - Applications

SOLID PROPELLANTS: Classification, Propellant Characteristics, Hazards, Propellant Ingredients, Other Propellant Categories, Liners, Insulators, and Inhibitors, Propellant Processing and Manufacture -Applications

TEXT BOOKS

1. Yahya, S. M., Turbines, Compressors and Fans, 4th Edition, Tata McGraw Hill, 2010.
2. Sutton, G. P. and Biblarz, O., Rocket Propulsion Elements, 7th Edition, John Wiley & Sons, Inc., Singapore, 2001.

REFERENCES

1. Sarvanamuttoo, H.I.H., Rogers, G. F. C. and Cohen, H., Gas Turbine Theory, 6th Edition, Pearson Prentice Hall, 2008.
2. Martin J.L. Turner, Rocket and Spacecraft Propulsion, Springer publications
3. Ganesan, V., Gas Turbines, 3rd Edition, Tata McGraw Hill, 2010.

VI SEMESTER

S414 - TRIBOLOGY

Prerequisite Subject: Machine Design –I, II

Course Educational Objectives:

The main objectives of the course are:

1. To learn the basic concepts of Tribology and its significance
2. To understand the nature of engineering surfaces, their topography and learn about surface characterization techniques
3. To understand the principle of lubrication, theories of hydrodynamic and mixed boundary lubrication.
4. To learn about consequences of wear, wear mechanisms, wear theories and analysis of wear problems
5. To understand the principles of bearing selection, its arrangement in machines

Course Outcomes:

After completion of the course students are able to:

1. Apply the concepts of principles of Tribology with particular emphasis on lubricated systems.
2. Analyze the various design parameters of bearings under different loads, temperature conditions.
3. Calculate the wear percentage by using different wear theories
4. Identify the wear mechanisms on rubbing surfaces.
5. Design the various types of antifriction bearings, and general requirements of bearing materials

UNIT - I

INTRODUTION TO TRIBOLOGY: Tribology and their characteristic feature, analysis and assessment of surface, Topography, Deterministic and Stochastic, Tribo models for asperity contacts, Techniques of surface examination, and Technological properties of surfaces.

FRICTION AND WEAR: Types of friction, Theories of friction, Study of current concepts of boundary friction and dry friction, friction reducing measures. Causes of wear, Types of wear, Mechanism of various types of wear, laws of wear, effects of wear

UNIT - II

VISCOSITY AND LUBRICANTS: Viscosity, flow of fluids, viscosity and its variation - absolute and kinematic viscosity, temperature variation, viscosity index determination of viscosity, different viscometers used, Viscosity standards, Lubricants and their physical properties, Various theories of lubrication

UNIT - III

THEORY OF HYDRODYNAMIC LUBRICATION: Petroffs equation, Reynolds's equation in two dimensions, bearing modulus, Somerfield number, Effects of side leakage, pressure, flow, load capacity and friction calculations, heat balance, minimum oil film thickness, oil whip and whirl.

UNIT – IV

THEORY OF HYDROSTATIC LUBRICATION: Hydrostatic step bearing, pivoted pad thrust bearing, hydrostatic lifts, hydrostatic squeeze films, pressure, flow, load capacity and friction calculations, oil rings, pressure feed bearing, partial bearings, externally pressurized bearings, Air lubricated bearing, Advantages and disadvantages

UNIT - V

ANTI-FRICTION BEARINGSAND BEARING MATERIALS : Anti-friction bearings, types, Advantages and disadvantages, General requirements of bearing materials, types of bearing materials, General bearing design considerations.

TEXT BOOK

1. Basu S.K, SenGupta and Ahuja, Fundamentals of Tribology PHI Learning Private Limited, 2009.
2. Gwidon W Stachowiak and Andrew W Batchlor, Engineering Tribology, 3rd Edition, Elsevier

REFERENCE BOOKS

1. Sushil Kumar Srivatsava, Tribology in Industry**,** S. Chand &Co.
2. B.C. Majumdar, Tribology, S.Chand& Co
3. Rabinowicz, Friction and Wear of materials, John willey& Sons.
4. Halling. J, Macmillian, Principles of Tribology,.
5. Williams .J.A, Engineering Tribology, Oxford University Press.

VI SEMESTER

S174 - CONTROL SYSTEMS

(Common to ECE, EEE, ME)

Prerequisite Subject: Applied Mathematics –I, II

Course Education Objectives:

The main objectives of the course are:

1. To learn the open loop and closed loop control systems and its block digrams
2. To demonstrate the time response analysis of standard test signals
3. To identify the differences between the time response and frequency response analysis of standard test signals
4. To teach linear systems for steady state errors, absolute stability and relative stability

Course Outcomes:

After completion of the course students are able to:

1. Analyze electromechanical systems by mathematical modeling.
2. Determine Transient and Steady State behavior of systems using standard test signals.
3. Analyze linear systems for steady state errors, absolute stability and relative stability
4. Identify and design a control system to satisfy given requirements.

UNIT – I

INTRODUCTION

Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions – Translational and Rotational mechanical systems. Transfer Function of DC Servo motor - Block diagram representation of systems considering electrical systems as examples -Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula.

UNIT – II

TIME RESPONSE ANALYSIS

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral, PID systems.

UNIT – III

FREQUENCY RESPONSE ANALYSIS

Introduction, Frequency domain specifications Polar Plots -Bode diagrams-Determination of Frequency domain specifications and Transfer function from the Bode Diagram-Phase margin and Gain margin- Nyquist Plots.

UNIT – IV

STABILITY ANALYSIS

The concept of stability – R-H stability criterion – qualitative stability and conditional stability – limitations of Routh's stability, The root locus concept - construction of root loci-effects of adding poles and zeros to G(s)H(s) on the root loci, Stability Analysis from Bode Plots -Nyquist Plots.Compensation techniques – Lag, Lead, Lead-Lag Compensator design in frequency Domain.

UNIT – V

STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS

Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

TEXT BOOKS

1. B. C. Kuo , "Automatic Control Systems" John wiley and son's ,8th edition, 2003.
2. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International (P) Limited Publishers,2nd Edition.

REFERENCES

1. Katsuhiko Ogata , "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 3rd edition,1998.
2. Norman S. Nise, Control Systems Engineering, 4th Edition, John Wiley, New Delhi,
3. Richard C Dorf, Robert H Bishop, Modern control systems , 8th edition, Prentice Hall (Pearson education, Inc.), New Delhi 2003.
4. Benzamin C. Kuo and Farid Golnaraghi, Automatic Control ystems, 8th Edition, John Wiley, New Delhi, 2003.

VI SEMESTER

S402– THEORY OF ELASTICITY

(Common to AE, ME)

Prerequisite Subject: Mechanics of Materials

Course Educational Objectives:

The objective of this course is

1. To understand the principles of elasticity theory and to find of stress in elastic stress analysis
2. To understand the displacement of simple beams
3. To acquire the knowledge analysis of linear elastic solids under mechanical loads.
4. To learn the Airy stress functions for 2-D plane stress and plane strain problems in Cartesian and cylindrical coordinate systems
5. To understand the stress functions for rectangular and circular cross-sectional cantilever beams.

Course Outcomes:

After completion of the course student will be able to:

1. Analyze the equations of compatibility by using plane stress and plane strain conditions.
2. Apply Saint Venant's principles to determine the displacements of simple beams.
3. Analyze the stresses and strains in 3-Dimensional problems.
4. Solve the linear elasticity problems using various analytical techniques.
5. Analyze the vectors and tensors to enhance the theory of elasticity where ever necessary

UNIT - I

ELASTICITY: Two dimensional stress analysis - Plane stress - Plane strain - Equations of Compatibility - Stress function - Boundary conditions.

PROBLEM IN RECTANGULAR COORDINATES - Solution by polynomials - Saint Venant's principles -Determination of displacement - Simple beam problems.

UNIT - II

PROBLEMS IN POLAR COORDINATES - General equations in polar coordinates - Stress distribution symmetrical about axis - Strain components in polar coordinates - Simple and symmetric problems.

UNIT - III

ANALYSIS OF STRESS AND STRAIN IN THREE DIMENSIONS - Principle stresses – Homogeneous deformations – Strain at a point – Principal axes of strain - Rotation.

UNIT - IV

GENERAL THEOREMS: Differential equations of equilibrium and conditions of compatibility – Determination of displacement - Uniqueness of solution - Reciprocal theorem.

UNIT - V

BENDING OF PRISMATIC BARS - Stress function - Bending of cantilever beam - Beam of rectangular cross-section - Beams of circular cross-section.

TEXT BOOKS

1. Timoshenko &Goodier, Theory of Elasticity 6th Edition 2009- McGraw Hill
2. A.I.Lurie, Theory of Elasticity, 4th Edition 2005-SpringerVerlag New York, LLC

REFERENCES

1. Dr.Sadhu Singh, Applied stress analysis, Khanna Publishers
2. Dally and Riley, Experimental stress analysis, McGraw-Hill
3. LOVE .A.H, A treatise on Mathematical theory of Elasticity, Dover publications Inc
4. A.Meceri, Theory of Elasticity, Springer

VI SEMESTER

S141 - AUTOMOBILE ENGINEERING

Prerequisite Subject: ICGT, Thermal Engineering

Course Educational Objectives:

1) To understand components of an automobile and functions of each component.
2) To learn working of fuel injection pumps and advanced injection systems used.
3) To understand detailed study of sensors and modern Ignition systems.
4) To understand the working of transmission system components.
5) To acquire knowledge about suspension and braking systems in automobiles and concept of steering geometry related to Vehicle dynamics applications.

Course Outcomes:

After completion of the course student will be able to:

1) Develop different components of an automobile.
2) Develop the fuel feed systems in SI and CI engines, Sensors and Ignition systems.
3) Design various transmission systems.
4) Analyze the simple design oriented problems related to suspension systems, steering systems and braking systems

UNIT - I

INTRODUCTION: Components of Automobile-The Basic Structure-Power Unit-Chassis and Frame-Rear Wheel Drive- Front Wheel Drive- Four Wheel Drive

ENGINE: Basic Terminology of engines- Scavenging process- firing order- Engine Construction Details-Cylinder block and crank case, Cylinder head, Oil pan, manifolds, Gaskets, Cylinder Liners, Types of Pistons and Piston rings, Connecting rod, Engine valves.

UNIT - II

FUEL SUPPLY SYSTEMS IN PETROL ENGINES: Fuel Supply Systems- Fuel pumps-Electrical pumps –Fuel Filters- Functions of Carburettor-Simple Carburettor-Defects in Simple Carburettor- SU type Carburettor- Petrol Injection- Multi Point Fuel Injection System-Gasoline fuel Injection-Throttle body, port Injection, Continuous Injection systems

FUEL SUPPLY SYSTEMS IN DIESEL ENGINES: Requirements ofDiesel InjectionSystem-Types of Injection Systems-Fuel Feed Pump-Fuel Injection Pump, Jerk type fuel Injection pump, Distribution type of pump-Fuel Injector-Types of Nozzles

UNIT - III

IGNITION SYSTEM: Functions-Battery Ignition system- Components of battery ignition system- Spark plug defects- Magneto coil Ignition System- Electronic Ignition- capacitive discharge ignition system (CDI).

ELECTRONICS SYSTEMS: Sensors-Electromagnetic sensors, Optical sensors, Combustion knock sensors, Variable resistance type sensors, Temperature sensors, Manifold absolute pressure (MAP) sensors, Exhaust gas oxygen sensors, Air-flow measurement, Traction control, Stability control.

UNIT - IV

ELECTRICAL SYSTEM: Starting motor-Bendix Drive Mechanism-Solenoid Switch-Electrical Circuit of lighting system -Horn-Wiper.

TRANSMISSION: Clutches-Principle-Types- Single-plate and Multi-plate clutches-Centrifugal clutches-Gear Boxes-Types-Sliding Mesh-Constant Mesh- Principle of automatic transmission, Torque convertor- propeller shaft- Hotch Kiss Drive-Differential

UNIT - V

FRONT AXLE AND STEERING SYSTEM: Introduction, Front axle, Factors of wheel alignment, Steering Geometry-Camber- King pin inclination- Combined Angle and scrub radius-castor- Toe-In- Toe-out-Correct steering angle- Steering mechanisms- Under steer and Over steer- Power Steering.

SUSPENSION SYSTEMS: Objectives of Suspension systems- Types of suspension springs, Leaf springs, Coil springs, Torsion bar, Shock absorbers- Independent suspension-Air Suspension.

BRAKING SYSTEMS: Principle- Braking requirement- Differences between Drum and Disc brakes- Hydraulic Brake operating systems, Air brakes, Antilock Braking system

TEXT BOOKS

1. Dr. Kirpal Singh, Automobile Engineering-Vol I& II, 12th Edition, Standard Publishers distributors, 2011.
2. William H Crouse and Donald L Anglin, Automotive Mechanics, 10th Edition, The McGraw-hill companies, 2008.

REFERENCES

1. R.B.Gupta, Automobile Engineering, 8th edition, Tech India publication series, 2013.
2. V.A.W Hillier and David R.Rogers, Hillier's Fundamentals of Motor Vehicle Technology, Book1, 5th edition- 2007.
3. Heinz Heisler, Advanced Vehicle Technology, 2nd edition, Butterworth-Heinemann series, 2002.
4. David A Crolla, Automotive Engineering,1st edition, Butterworth-Heinemann series, 2009.

VI SEMESTER

S294 - MACHINE TOOL DESIGN

Prerequisite Subject: Metal cutting & Machine Tools

Course Educational Objectives:

The objectives of the course are to

1. Understand the basic mechanisms in machine tools.
2. Familiarize with speed and feed used in machine tools.
3. Understand the design concepts of gear box, bed, frames, columns and machine tool.
4. Acquire basic knowledge in hydraulic controls.

Course Outcomes:

After completion of the course student will be able to:

1. Develop a suitable mechanism for a particular machine tool.
2. Develop skills for designing machine components and machine tools
3. Design gear box, bed frames, columns of machine tools.
4. Perform machine tool alignment test.
5. Analyze hydraulic and pneumatic systems of various machine tools.

UNIT- I

CLASSIFICATION OF MACHINE TOOLS. Mechanisms used for converting rotary to linear motion and intermittent motion. Kinematic structures of machine tools - general purpose, special purpose, automatic screw cutting machines. Basic features of transfer machines.Numerical Control of machine tools, advantages and limitations. Schematic diagrams of NC systems.

UNIT-II

DRIVES OF MACHINE TOOLS; selection of range of speeds and feeds. Speed layout in GP, AP and logarithmic progression. Standardization of speeds and feeds.Productivity loss. Selection of highest and lowest speeds, range ratio.Design of ray diagram and structural diagrams for machine tool gear boxes.Determination of number of teeth and module of gears in gear box design. Rules for layout of gear box having sliding clusters. Sliding cluster and clutched drives, Ruppert drive.

UNIT-III

FEED GEAR BOXES: Norton and Meander gear boxes. Stepped and step less regulation of speeds. Strength and Rigidity design analysis. Design of beds, frames, Columns and Guide ways.Materials for structures.Methods to improve the rigidity of structures.Overall compliance of machine tool.Thermal effects - functional accuracy of machine tool.

UNIT-IV

SPINDLE UNITS; Spindles of lathe, Drilling, Milling and Grinding machines materials for spindles. Spindle design.Effect of clearance on the rigidity of spindle.Hydro-dynamic and Hydro-static bearings; Requirements of spindle bearings.

MACHINE TOOL ALIGNMENT TESTS: Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling, drilling machine tools.

UNIT-V

HYDRAULIC CONTROLS: various controls used in machine tools. Hydraulic and Pneumatic systems used in machine tools. Positive displacement pumps. Power pack. Relief valves, check valves, flow control valves, multi position direction control valves, Filters, Accumulators. Speed regulation of surface grinding machine. Hydro- copying systems.

TEXT BOOKS

1. G C Sen& Bhattacharya, Principles of machine tools, New Central Book Agency, Calcutta.
2. N K Mehta, Machine Tool Design and Numerical Control, Tata McGraw-Hill Publishing co. Ltd.

REFERENCES

1. N.Acherkan, Machine Tool Design, University press of the pacific, 2000.
2. S.K.Basu, Design of machine tools, Allied Publishers
3. S R Majumdar, Hydraulic Systems- Principles & Maintenance, Tata McGraw-Hill Publishing CompanyLimited; New Delhi

VI SEMESTER

S427 - WORK STUDY AND ERGONOMICS

Prerequisite Subject: Operations Research, Industrial Management

Course Educational Objectives:

The objective of this course is to:

1. Underline the importance of Human Factors in engineering design.
2. Create awareness about the need of concepts of Ergonomics in systems design.
3. Describe application of Ergonomics principles to design industrial work places.
4. Illustrate about various work measurement techniques.
5. Discuss the principles of physical ergonomics.

Course Outcomes:

After completion of this course, student will be able to:

1. Determine time standards with allowances for appropriate work tasks.
2. Apply concepts of ergonomics in evaluation of a real world system.
3. Exhibit the ability to design or redesign of workstations using ergonomically knowledge.
4. Design effective man-machine systems.
5. Apply physical ergonomic techniques to improve worker safety.

UNIT- I

WORK STUDY: Definition, Objective and Scope of work study, Human factor in work study. Work study and management, work study and supervision, work study and worker.

METHOD STUDY: Definition, objective and scope of method study, activity recording and exam aids. Charts to record moments in shop operation – process charts, flow process charts, travel chart and multiple activity charts.

UNIT -II

WORK MEASUREMENT: Definition, objective and benefit of work measurement. Work measurement techniques. Work sampling: need, confidence levels, sample size determinations, random observation, conducting study with the simple problems.

UNIT- III

ERGONOMICS: Introduction, areas of study under ergonomics, system approach to ergonomics model, man-machine system. Components of man-machine system and their functions – work capabilities of industrial worker, study of development of stress in human body and their consequences. Computer based ergonomics

UNIT- IV

METHODS OF ANALYSIS: Introduction to Physical Methods, Musculoskeletal Discomfort Surveys Used at NIOSH, the Dutch Musculoskeletal Questionnaire (DMQ), Rapid Upper Limb Assessment (RULA), Rapid Entire Body Assessment,

ANTHROPOMETRIC PRINCIPLES IN WORKSPACE AND EQUIPMENT DESIGN: Designing for a population of users Sources of human variability, Anthropometry and its uses in ergonomics, Principles of applied anthropometry in ergonomics, Application of anthropometry in design

UNIT- V

HUMAN FACTOR ENGINEERING: Definition, history and development of human factors engineering, types &characteristics of man-machine-system, relative capabilities of human being and machines; development and use of human factor data; information input and processing.

TEXT BOOK

1. R.S.Bridger, Introduction to Ergonomics; Taylor & Francis group, 3rd Edition 2008

REFERENCES

1. Neville Stanton at al., Handbook of Human Factors and Ergonomics Methods; CRC Press,2009
2. Khan MI; Industrial Ergonomics; PHI Learning
3. ILO; work-study; International Labour Organization

VI SEMESTER

L150 - HEAT TRANSFER LAB

Prerequisite Subject: HEAT TRANSFER

Course Educational Objectives

1. To learn the concepts of conduction, convection and radiation in practically by conducting experiments.
2. To understand the performance of fins, Heat Pipes.
3. To learn the physical mechanism of Natural Convection and Forced Convection
4. To learn the basic knowledge of radiation mechanism by conduction the experiments of emissivity apparatus and Stefan Boltzmann apparatus.
5. To learn the LMTD and Effectiveness of Heat Exchangers.

Course Outcomes:

After completion of the course students are able to:

1. Analyze the modes of heat transfer problems in the practical perspective.
2. Develop knowledge in making calculations for thermal conductivity of insulating materials and solids of various heat transfer equipment.
3. Acquires the real time steady state and transient heat conduction problems,
4. Apply the concepts of heat transfer in the simple design of various types of fins for different geometry
5. Design and develop the simple heat exchanger systems.

LIST OF EXPERIMENTS

At least 10 Experiments are required to be conducted

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer in forced convection apparatus.
8. Heat transfer in natural convection
9. Parallel and counter flow heat exchanger.
10. Emissivity apparatus.
11. Stefan Boltzmann Apparatus.
12. Heat transfer in drop and film wise condensation.
13. Critical Heat flux apparatus.
14. Study of heat pipe and its demonstration.
15. Study of Two – Phase flow.

REFERENCES:

LAB MANUALS

VI SEMESTER

L119 - COMMUNICATION AND PRESENTATION SKILLS LAB

(Common to all branches)

Prerequisite: English -I, English - II

Course Educational Objectives

In this course, the students will learn to

1. Gather information and to organize ideas relevantly and coherently
2. Participate in group discussions and debates, Face interviews
3. Write project/research reports/technical reports/ formal letters
4. Make oral presentations
5. Transfer information from non-verbal to verbal texts and vice versa

Course Outcomes

After the completion of this course, prospective engineers will have the ability to

1. Make power point presentations and oral presentations
2. Articulate English with good pronunciation
3. Face competitive exams like GRE, TOEFL, IELTS etc.
4. Face interviews and skillfully manage through group discussions
5. Negotiate skillfully for better placement

The following course content is prescribed for the Communication and presentations Lab:

- Vocabulary building – synonyms and antonyms, one-word substitutes, analogy, idioms and phrases, verbal & alphabet series.
- Oral Presentations – JAM
- Functional English - starting a conversation – responding appropriately and relevantly – using the right body language – role play in different situations.
- Group Discussion – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
- Making power point presentations.
- Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, practicing mock-interviews.
- Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets, summary, formats and styles, letter-writing.
- Reading comprehension – reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, and critical reading.

MINIMUM REQUIREMENT:

THE ENGLISH LANGUAGE LAB SHALL HAVE TWO PARTS:

i. **THE COMPUTER AIDED LANGUAGE LAB**for 60 students with 60 systems, one master console, LAN facility and English language software for self- study by learners.

ii. **THE COMMUNICATION SKILLS LAB**with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and camcorder etc.

SYSTEM REQUIREMENT (HARDWARE COMPONENT):

Computer network with LAN with minimum 60 multimedia systems with the following specifications:

i. P – IV Processor

1. Speed – 2.8 GHZ
2. RAM – 512 MB Minimum
3. Hard Disk – 80 GB

ii. Headphones of High quality

SUGGESTED SOFTWARE:

- Glob arena's software,2002
- Young India's Clarity software,2005

REFERENCES:

1. Stephen Bailey , "Academic Writing- A Practical guide for students", RontledgeFalmer, London & New York, 2004.
2. Dr A Ramakrishna Rao,Dr G Natanam& Prof SA Sankaranarayanan, "English Language Communication : A Reader cum Lab Manual, Anuradha Publications, Chennai, ,1st edition,2006
3. DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice, New Age International (P) Ltd., Publishers, New Delhi,2007
4. Books on TOEFL/GRE/GMAT/CAT by Barron's/cup, ,15th edition,2010
5. IELTS series with CDs by Cambridge University Press.3rd Edition,2007

VII SEMESTER

S250 - FINITE ELEMENT METHOD

(Common to AE, ME)

Prerequisite Subject: Applied Mathematics, Mechanics of Material, Machine Design –I, II

Course Educational Objectives: The objectives of this course are to

1. Understand the concepts such as discretization, natural co-ordinates, interpolation functions, stiffness matrix, force vectors, nodal displacements, boundary conditions etc
2. Understand the beams subjected to different loads
3. Understand the concepts of axisymmetric solids subjected to axisymmetric loading and the importance of isoparametric elements
4. Understand the steady state heat transfer through plane walls and fin
5. Understand the Eigen value and Eigen vectors for dynamic problems

Course Outcomes: At the end of this course each student will be able to

1. Identify mathematical model for solution of common engineering problems
2. Determine the design quantities (deformation, strain, stress) for engineering structures under different loading conditions.
3. Formulate the design and heat transfer problems with application of FEM.
4. Create new solutions for the existing problems using FEM approaches.
5. Evaluate the natural frequencies of bar and beam structures

UNIT - I

INTRODUCTION TO FINITE ELEMENT METHOD FOR SOLVING FIELD PROBLEMS:

Stress and Equilibrium - Strain – Displacement relations- Stress – strain relations **ONE DIMENSIONAL PROBLEM:** Finite element modeling coordinates and shape functions- Potential Energy approach - Assembly of Global stiffness matrix and load vector- Finite element equations- Treatment of boundary conditions

UNIT - II

ANALYSIS OF BEAMS: Hermite shape functions - Element stiffness matrix for two nodes, two degrees of freedom per node beam element – Treatment of boundary conditionsFinite element modeling of two dimensional stress analysis with Constant Strain Triangles and treatment of boundary conditions.

UNIT - III

AXISYMMETRIC LOADING AND NUMERICAL INTEGRATION :

Finite element modeling of axisymmetric solids subjected to axisymmetric loading with triangular elements.Two dimensional four nodedisoparametric elements, problems on isoperimetric formulation of four node quadrilateral elementNumerical integration-Gauss quadrature

UNIT - IV

HEAT TRANSFER : Heat conduction in plane walls, convection heat transfer in fins.Two dimensional analysis of thin plate with triangular elements-Element conductivity matrix-Convection matrix-Heat rate vector

UNIT - V

DYNAMIC ANALYSIS: Formulation of finite element model-Lumped and consistent massmatrices-Evaluation of Eigen values and Eigen vectors for a stepped bar.

TEXT BOOKS

1. Chandraputla, Ashok and Belegundu, Introduction to Finite Elements in Engineering, 3rd edition, 5th impress, Prentice – Hall, 2008.
2. SS Rao, The Finite Element Methods in Engineering, 4th edition, 6th reprint, B.H.Pergamon, 2010.

REFERENCES

1. JN Reddy, An introduction to Finite Element Method, 3rd edition, 13th reprint, McGraw Hill, 2011.
2. Kenneth H. Huebner, Donald L. Dewhirst, Douglas E Smith and Ted G. Byrom, The Finite Element Method for Engineers, 4th edition, John Wiley & sons (ASIA) Pvt Ltd, 2001.
3. David Hutton, Fundamentals of Finite Element Analysis, Tata McGraw Hill, 2005
4. George R Buchanan and R.RudraMoorthy, Finite Element Analysis, Tata McGraw Hill, 2006

VII SEMESTER

S154 - CAD/CAM

(Common to AE, ME)

Prerequisite Subject: Machine Tools

Course Educational Objectives: To familiarize the students about:

1. Appraisal of computers in design and manufacturing fields.
2. Modelling of geometry using various entities and methodology.
3. Principles and different aspects of Numerical control and part programming.
4. Requisition for Group technology and FMS for advanced manufacturing firms.
5. Distinctive CAQC techniques and implementation of CIM in manufacturing.

Course Outcomes:

After completion of the course students are able to:

1. Apply CAD/CAM principles for geometric modelling, design and manufacturing
2. Generate codes for part profiles and can accomplish machining.
3. Codify the part using GT codes and can apply GT system in automated manufacturing firm.
4. Be cognizant of CAQC techniques that are to be applied in manufacturing.
5. Comprehend the applications of Computer Integrated Manufacturing.

UNIT - I

FUNDAMENTALS OF CAD: Introduction – The design process – The application of computers for design- Engineering data management– Benefits of CAD.

COMPUTER GRAPHICS: Raster scan graphics-Coordinate systems-Database structure for graphics modeling-Transformation of geometry: Translation, scaling, reflection, rotation, homogeneous transformations Concatenated transformations.

UNIT – II

GEOMETRIC MODELING: **REPRESENTATION OF CURVES**: Introduction, wireframe models, wireframe entities, curve representation, parametric representation of analytical curves, parametric representation of Bezier and B-Spline curves.

REPRESENTATION OF SURFACES AND SOLIDS: Introduction to surfaces, surface models surface entities. Introduction to solids, solid models, solid entities, Fundamentals of solid modeling, Boundary representation, CSG representation, sweep representation.

UNIT – III

COMPUTER NUMERICAL CONTROL: Introduction – NC modes – NC elements -NC Coordinate systems – Structure of CNC Machine Tools – Spindle design –Spindle drives – Feed drives – actuation systems.

PART PROGRAMMING: Part programming Fundamentals – Manual part programming-computer aided part programming: APT Language.

UNIT - IV

GROUP TECHNOLOGY: Introduction – part families – part classifications and coding – OPITZ system – MICLASS system – CODE system – GT Machine cells – Benefits of GT – CAPP: Retrieval type and generative type

FLEXIBLE MANUFACTURING SYSTEM: Introduction – FMS components – Benefits of FMS – FMS planning and implementation Issues.

UNIT - V

COMPUTER AIDED QUALITY CONTROL: Introduction –computers in QC – Contact Inspection methods – Non contact inspection methods: optical, non optical – Computer Aided Testing-Integration of CAQC with CAD/CAM.

COMPUTER INTEGRATED MANUFACTURING SYSTEMS:Introduction–Integration-CIM implementation – Benefits of CIM – Lean manufacturing.

TEXT BOOKS

1. MikelP.Groover and Emory W.Zimmers, CAD/CAM-prentice Hall of India private Ltd.New Delhi, 20th edition, May 2010.
2. Ibrahim Zeid, Mastering CAD/CAM, TATA McGraw-Hill publishing CO.Ltd, New Delhi2011.

REFERENCES

1. PN Rao,CAD/CAM Principle and applications, Tata McGraw Hill Education Private Ltd,New Delhi,8th edition 2013.
2. P.Radhakrishnan,S.Subramanyam&V.Raju,CAD/CAM/CIM,New Age International Publishers,3rd edition 2010.
3. MikelP.Groover,Automaiton,Production Systems and Computer Integrated Manufacturing, Prentice Hall of India private Ltd.New Delhi, 3rd edition, May 2008.
4. Ibrahim Zeid and R. Sivasubramanian, CAD/CAM theory and practice, Tata McGraw Hill publishing Co. Ltd,New Delhi 2009.
5. Tien-Chienchang, Richard A.Wysk and HSU-Pin (Ben) Wang, "Computer Aided Manufacturing",3rdedition,2006
6. Michael E.Mortenson,"Geometric Modelling", John Wiley and sons, Inc., James D.Foley, Andries Van Dam, Steven K.Feiner, John F. Hughes, "Computer Graphics Principles and Practice", Addison-Wiley publishing Company,2nd Edition 2007.

VII SEMESTER

S367 - REFRIGERATION AND AIR CONDITIONING

Prerequisite Subjects: Thermodynamics, Thermal Engineering, Heat Transfer

Course Educational Objectives:

1. To understand and acquire the terminology used in refrigeration and air-conditioning.
2. To acquire the knowledge on VCR system.
3. To learn the performance and cycle analysis pertaining to VAR systems.
4. To understand the psychometric processes of air-conditioning systems.
5. To know the concepts of A/C systems and its load estimation procedures for different Air conditioning systems.

Course Outcomes:

After completion of the course, students are able to:

1. Demonstrate the basic concepts of refrigeration and related performance parameters.
2. Analyze the performance of VCR and VAR systems and differentiate with one another.
3. Design and develop the refrigerators using the VCR principles.
4. Demonstrate of psychometric properties and processes used in Air Conditioning.
5. Design and develop the Air-conditioning systems for thermal comfort conditions.

UNIT - I

FUNDAMENTALS OF REFRIGERATION: Introduction- Necessity and applications, unit of refrigeration and C.O.P-Heat Engine, Refrigerator and Heat pump-Types of Refrigeration systems, and its Applications.

REFRIGERANTS: Classification of refrigerants- Desirable properties-Nomenclature-Commonly used refrigerants- Alternate refrigerants –Green house effect, global warming

AIR REFRIGERATION SYSTEM: Introduction-Air refrigeration system working on Reversed Carnot cycle – Air refrigeration system working on Bell Coleman cycle- COP-Open and Dense air systems, Applications.

UNIT - II

VAPOUR COMPRESSION REFRIGERATION SYSTEM: Working principle-Simple vapour compression refrigeration cycle – COP- Representation of cycle on T-s and P-h charts- Effect of Sub cooling and Superheating --Actual Vapour compression cycle and its applications.

VCR SYSTEM COMPONENTS: Compressors-Classification-Working -Condensers – Classification-Working-Evaporators –Classification-Working, Expansion devices –Types-Working.

UNIT - III

VAPOUR ABSORPTION REFRIGERATION SYSTEM: Description and working of Aqua-Ammonia system- Calculation of maximum COP- Lithium Bromide- Water system-Principle of operation of Three fluid absorption system, Applications.

STEAM JET REFRIGERATION SYSTEM: Principle of working –Analysis-Applications.

NON CONVENTIONAL REFRIGERATION SYSTEMS- Thermo electric Refrigeration, Vortex tube refrigeration, Adiabatic demagnetization Refrigeration.

UNIT - IV

PSYCHROMETRY: Introduction - Psychrometric properties and relations- Psychrometric chart Psychrometric processes-Sensible, Latent and Total heat–Sensible Heat Factor and Bypass Factor.

HUMAN COMFORT: Thermodynamics of Human body-Effective temperature – Comfort chart.

UNIT - V

AIR CONDITIONING SYSTEMS: Introduction-Components of Air conditioning system-Classification of Air conditioning systems-Central and Unitary systems- Summer, Winter and Year round systems- Cooling load estimation.

DESIGN OF AIR CONDITION SYSTEMS: Summer air conditioning –ADP-System with Ventilated and re-circulated air with and without bypass factor- RSHF, GSHF and ESHF.

NOTE: Refrigerants &Psychrometric properties- by M.L. Mathur& F.S. Mehta data book will be supplied in the exam hall.

TEXT BOOKS

1. C. P. Arora. , Refrigeration and air conditioning - TMH, 2nd Edition, 2000.
2. R. Dossat, Principles of Refrigeration - - Pearson 4th Edition 2001

REFERENCES

1. S. C. Arora, Domkundwar, A course in refrigeration and air conditioning-Dhanapat Rai& sons 5th Edition 1997.
2. Manohar Prasad, Refrigeration and Air conditioning, New Age international, 2003
3. Wilbert F.Stoecker, Jerold W. J.Jones, MGH, 1986.

VII SEMESTER

S310 - METROLOGY AND INSTRUMENTION

Prerequisite Subject: Modern Machining Processes

Course Educational Objectives:

The objectives of this course are to:

1. Learn the basics of measurement system and experimental errors.
2. Learn about linear, angular and optical measuring instruments.
3. Familiarize with surface roughness measurement and limits and fits.
4. Learn about measurement of Displacement, Stress and Strain, and Force and Torque.
5. Learn about measurement of Pressure, Fluid flow and Temperature.

Course Outcomes:

After completion of the course student will be able to:

1. Apply different measuring techniques in quality control departments of industries and to ensure quality of products.
2. Design and use effectively the instruments for measure linear, angular and optical.
3. Analyze measuring systems of surface roughness and perform alignment/acceptance test effectively.
4. Design and use effectively the instruments for measuring stress, strain, force, torque etc.
5. Analyze measuring systems of Pressure, Fluid flow and Temperature.

UNIT – I

BASIC CONCEPTS: Introduction, Fundamental Measuring Processes and methods, Generalized measurement system and its functional elements, Performance characteristics.

ANALYSIS OF EXPERIMENTAL DATA: Causes and types of experimental errors, Treatment of experimental data, Method of least squares, Graphical analysis and curve fitting.

UNIT - II

LINEAR MEASUREMENT: Standards of measurements- line and end standard. Basic principle and applications of slip gauges, dial indicator and micrometers.

ANGULAR MEASUREMENTS: Bevel protractor – angle slip gauges – sine bar, rollers and spheres used to determine the tapers, Applications of angular measurement.

OPTICAL MEASURING INSTRUMENTS: Tool maker's microscope and its uses – collimators, optical projector – optical flats and their uses, interferometer, and those applications.

UNIT – III

SURFACE TEXTURE: Factors effecting surface roughness, reasons for controlling surface texture, Differences between surface roughness and surface waviness, Elements of surface texture -Numerical assessment of surface finish – CLA, R, R.M.S Values – Ra values, and Rz values. Basic principle of profile meter and Tomlinson surface meter. ISI symbols for indication of surface finish, Applications surface texture.

LIMITS AND FITS: Introduction, Normal size, Tolerance limits, Deviations, Allowance, Fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly. Indian standard Institution system

UNIT – IV

MEASUREMENT OF DISPLACEMENT: Introduction, Classification, Dimensional measurement, Gauge blocks, Optical methods, Pneumatic gauge, Applications of displacement measurement.

MEASUREMENT OF STRESS AND STRAIN: Introduction, Strain measurements, Electrical Resistance Strain Gauge, gauge factor, Measurement of Resistance Strain-Gage Outputs, Temperature Compensation, Strain-Gage Rosettes , Strain gage Rosettes, Applications of strain measurement

MEASUREMENT OF FORCE AND TORQUE: Introduction,Elastic Transducer, Strain Gage Load Cells, Dynamometers- Mechanical, Hydraulic, Electrical, Applications of force and torque measurement.

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UNIT –V

MEASUREMENT OF PRESSURE: Introduction, Manometers, Dial type pressure gauge, Pressure Transducers, Pitot, Static, and Pitot-Static Tube and Its characteristics, Low Pressure Measurement Gauges, Applications of pressure measurement.

MEASUREMENT OF FLUID FLOW: Introduction, Rotameter, Turbine flow meter, Laser Doppler Anemometer, Hot-wire Anemometer, Applications of fluid flow measurement.

MEASUREMENT OF TEMPERATURE: Introduction, Types of thermometers, Thermocouples, RTD, Thermisters, Pyrometers, Applications of temperature measurement.

TEXT BOOKS

1. D.S.Kumar, Mechanical Measurements and Controls, 4th Edition, Metropolitan Book Co-Private Ltd.
2. R.K.Jain, Engineering Metrology, Khanna Publishers.3rd edition,2003
3. BeckWith, Marangoni,Linehard, Mechanical Measurements, Person Education Asia.6th edition,2011.

REFERENCES

1. A.K, Sawhneypuneet " A course in Mechanical Measurements and instrumentation control" DhanpatRai publications, 12thEdition, 2012
2. J.P. Holman, Experimental Methods for Engineers, McGraw Hill.
3. Ernest O. Doebelin, Measurement systems Application and Design, International Student Edition, 4thEdition, McGraw-Hill Book Company, 1998.
4. M. Mahajan, A text book of Metrology, DhanpatRai& Co.
5. I C Gupta, Engineering Metrology, DanpathRai

VII SEMESTER

S303 - MECHANICS OF COMPOSITES

(Common to AE, ME)

Prerequisite Subject: Mechanics of Materials

Course Educational Objectives:

The objectives of this course are to:

1. To teach the differences between the stress strain relations
2. To know the different properties of composite materials
3. To teach the symmetric and Anti symmetric laminates
4. To illustrate materials used for sandwich construction

Course Outcomes:

After completion of the course student will be able to:

1. Understand the composition of FRP composites, their classification, advantages, applications and manufacturing methods.
2. Observe for the number of independent elastic constants required to solve a structural problem depending on the type of anisotropy in the material
3. Transform the material properties from material coordinates to geometric coordinates
4. Understand the different failure theories of FRP composites
5. Understand the interactions of constituents at micro level and estimate the aggregate properties of composite
6. Analyze laminate by extending lamina analysis.

UNIT - I

STRESS STRAIN RELATION: Introduction- Definition of composites-classification Advantages and application and limitations of composite materials, reinforcements and matrices, Generalized Hooke's Law – Compliance and reduced stiffness matrix- stress-strain relation of orthotropic lamina.

UNIT- II

METHODS OF ANALYSIS: Micro mechanics – Mechanics of materials approach, elasticity approach to determine material properties – Macro Mechanics – Stress-strain relations with respect to on axis, off axis

UNIT- III

MULTI DIRCTIONAL COMPOSITES: Governing differential equation for a general laminate, Classical Lamination Theory- Symmetric, Antisymmetric laminates, angle ply and cross ply laminates. Failure criteria for composites.

UNIT- IV

SANDWICH CONSTRUCTIONS: Basic design concepts of sandwich construction - Materials used for sandwich construction - Failure modes of sandwich panels.

UNIT- V

FABRICATION PROCESSES: Open and closed mould processes, lay-up, Vacuum bagging, Pultrusion, ResinTransfer Molding - Auto Clave-Filament Winding

TEXT BOOKS

1. Calcote, L R. "The Analysis of laminated Composite Structures", Von – Noastrand Reinhold Company, New York 1998.
2. Jones, R.M., "Mechanics of Composite Materials", McGraw-Hill, Kogakusha Ltd.,Tokyo, 1998, 2nd Edition.

REFERENCES

1. Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites", John Wiley and sons. Inc., New York, 1995.
2. Lubin, G., "Handbook on Advanced Plastics and Fibre Glass", Von Nostrand Reinhold Co., New York, 1989.

VII SEMESTER

S231 - ENERGY CONSERVATION AND MANAGEMENT

Prerequisite Subject: Thermodynamics, Thermal Engineering

Course Educational Objectives:

1. To learn the basics of energy conservation and audit.
2. To learn the basics of waste heat recovery systems.
3. To learn the aspects of energy conservation methods in a variety of engineering situations.
4. To learn energy auditing procedures used in power plants.
5. To learn the economic issues based on energy utilization related to industries.

Course Outcomes:

After completion of the course students are able to:

1. Acquire knowledge on energy audit and energy conservation methods.
2. Acquire knowledge on cogeneration plant and other plants
3. Identify energy conservation opportunities and its implementation
4. Analyze practical relevance of waste heat recovery for plant economy and long term goals.
5. Apply economic methods for different thermal systems of a power plant.

UNIT - I

General energy problem, Energy uses patterns and scope of conversion.

ENERGY MANAGEMENT PRINCIPLE: Need, Organizing and managing an energy management program.

ENERGY AUDITING: Elements and concepts, Type of energy audits instruments used in energy auditing.

UNIT – II

ECONOMIC ANALYSIS: Cash flows, Time value of money, Formulae relating present and future cash flows- single amount, uniform series.

FINANCIAL APPRAISAL METHODS: Pay back periods, net present value, benefit cost ratio, internal rate of return and Life cycle cost / benefits.

UNIT – III

THERMODYNAMICS OF ENERGY CONSERVATION: Energy conservation in Boilers and furnace, Energy conservation in stream and condensate system.

COGENERATION: Concepts, type of cogeneration system, performance evaluation of a cogeneration system.

UNIT –IV

WASTE HEAT RECOVERY: Potential, benefit, waste heat recovery equipments. Space Heating, Ventilation Air Conditioning (HVAC) and water heating of building, Transfer of heat, space heating methods, Ventilation and air conditioning, Heat pumps, Insulation, Cooling load, Electric water heating systems, Electric energy conversation methods.

UNIT – V

ENERGY CONSERVATION IN ELECTRIC UTILITY AND INDUSTRY: Energy cost and two -part tariff, Energy conservation in utility by improving load factor, Load curve analysis, Energy efficient motors, Energy conservation in illuminating system, Importance of power factor in energy conservation - Power factor improvement methods, Energy conservation in industries.

TEXT BOOKS

1. Wayne C. Turner, **Energy management handbook -**, CRC PressPublications, 2004.
2. S.C.Tripathy, **Electrical Energy Utilization and Conservation-**TataMcGrawHill,1991.

REFERENCES

1. D.A. Reay, **Industrial Energy Conversation -**, Pergamon Press
2. **Industrial energy conservation Manuals**: MIT Press.

VII SEMESTER

S138 - AUTOMATION IN MANUFACTURING

Prerequisite Subject: Production Technology

Course Educational Objectives: To familiarize the students about:

1. Emphasis of Automation and Production systems in manufacturing area.
2. Automation in Material handling systems, transport systems, storage systems.
3. Frame of reference on manufacturing systems and manufacturing cells in production.
4. Distinctive functions of Manual and automated production lines.
5. Optimization in Adaptive Control systems and applications of Adaptive Control systems.

Course Outcomes:

After completion of the course students are able to:

1. Accomplish automation in manufacturing industry.
2. Apply the techniques of Automation material handling and storage equipments depending upon the application.
3. Analyze progress functions of manufacturing systems.
4. Apply various algorithms to solve manual and automated flow lines.
5. Apply the optimized Adaptive Control System in automation.

UNIT – I

INTRODUCTION TO AUTOMATION: Basic elements of automated system, advanced automation functions, levels of automation.

Production System Facilities, Manufacturing Support systems, Automation in Production systems, Automation principles & Strategies.

UNIT – II

AUTOMATED MATERIAL HANDLING: Types of equipment, considerations in material system design, the ten principles of material handling.

MATERIAL TRANSPORT SYSTEMS: Industrial trucks, automated guided vehicle systems, rail guided vehicles, conveyor systems, cranes and hoists.

STORAGE SYSTEMS: Storage system performance, storage location strategies, conventional storage methods and equipment, automated storage systems.

UNIT – III

INTRODUCTION TO MANUFACTURING SYSTEMS: Components of a Manufacturing system, Classification of Manufacturing Systems, overview of Classification Scheme, manufacturing progress functions.

SINGLE STATION MANUFACTURING CELLS: Single Station Manned Workstations and Single Station Automated Cells, applications, analysis of single station cells.

UNIT – IV

MANUAL ASSEMBLY LINES: fundamentals, alternative assembly systems, design for assembly, analysis of single model assembly lines, line balancing algorithms, mixed model assembly lines.

AUTOMATED FLOW LINES: Fundamentals of automated production lines, applications of automated production lines, analysis of transfer lines with no internal storage, analysis of transfer lines with storage buffers.

UNIT – V

AUTOMATED ASSEMBLY SYSTEMS: Fundamentals, design for automated assembly, quantitative analysis of assembly systems.

ADAPTIVE CONTROL SYSTEMS: Introduction, adaptive control with optimization, Adaptive control with constraints, Application of A.C. in Machining operations. Use of various parameters such as cutting force, Temperatures, vibration and acoustic emission.

TEXT BOOKS

1. Mikell P. Groover,"Automation, Production systems and computer integrated manufacturing", prentice Hall of India Private Ltd, New Delhi,3rd edition, 2008.
2. Yoramkorem,"Computer Control of Manufacturing Systems", Tata McGraw Hill publishing company private Ltd,New Delhi.

REFERENCES

1. P.Radhakrishan,S.Subramanyan,V.Raju,"CAD/CAM/CIM",New age International publishers,3rd edition,2010.
2. Pessan David W,"Industrial Automation" first edition, Wiley publishers, 2011.
3. W.Buekinsham"Automation", PHI publications.

VII SEMESTER

S331 - OPTIMIZATION METHODS AND APPLICATIONS

Prerequisite Subject: Operation Research

Course Educational Objectives:

The objective of this course is to:

1. Classify various optimization algorithms required for engineering systems.
2. Illustrate engineering design problem as a mathematical optimization problem.
3. Use mathematical software for the solution of engineering problem.
4. Enhance logical thinking required for problem solving.
5. Describe engineering problems as mathematical models.

Course Outcomes:

After completion of the course students are able to:

1. Apply concepts of optimization techniques to solve engineering problems.
2. Develop mathematical optimization models for a range of practical problems.
3. Design large-scale Linear and Integer Programming problems and then solve the problem.
4. Optimize parameters in the Engineering model.

UNIT -I

INTRODUCTION: Optimization – Historical Development – Engineering applications of optimization – Statement of an Optimization problem – classification of optimization problems.

UNIT -II

CLASSIC OPTIMIZATION TECHNIQUES: Linear programming - Graphical method – simplex method –Artificial variable methods-Big-M-Two Phase simplex– duality in Linear Programming, Revised simplex method, Sensitivity Analysis, Goal Programming, Applications.

UNIT -III

NON-LINEAR PROGRAMMING: Introduction – Lagrangeon Method – Kuhn-Tucker conditions – Quadratic programming – Separable programming – Stochastic programming – Geometric programming

UNIT -IV

INTEGER PROGRAMMING AND DYNAMIC PROGRAMMING: Integer programming - Branch and bound technique, Zero-one implicit enumeration – Dynamic Programming – Formulation, Various applications using Dynamic Programming. Network Techniques – Shortest Path Model – Minimum Spanning Tree Problem – Maximal flow problem.

UNIT- V

ADVANCES IN SIMULATION: Introduction, Simulations Models, Monte-Carlo Simulation, Simulation of Inventory Problems.Genetic algorithms – simulated annealing – Neural Network and Fuzzy systems,Applications

TEXT BOOKS

1. KalyanmoyDeb,Optimization for Engineering Design,PHI publishers,2nd edition, 2012
2. Hamdy A. Taha, Operations Research – An Introduction, Prentice Hall of India, 9th edition, 2010.

REFERENCES

1. R. Panneerselvam, “Operations Research”, Prentice Hall of India Private Limited,New Delhi 2nd edition, 2006.
2. Ravindran, Philips and Solberg, Operations Research Principles and Practice, John, Wiley & Sons, Singapore, 2nd edition, 2007.
3. J.K.Sharma, Operations Research – Theory and Applications – Macmillan India Ltd. 4th edition, 1997.
4. P.K. Guptha and Man-Mohan, Problems in Operations Research – Sultan Chand&Sons,3rd edition, 2009.

VII SEMESTER

S319 - NANO TECHNOLOGY

(Common to AE, EIE, ME)

Course Educational Objectives:

In this course student will learn about

1. The basics of Nanoscience and Technology.
2. Various process techniques available for the processing of Nanostructured materials.
3. The exotic properties of nanostructured materials at their nanoscale lengths.
4. Different nanoparticles synthesis methods and their skills.
5. The reactive merits of various process techniques.

Course Outcomes:

At the end of this course student will be able to

1. Have a sound grounding and expert knowledge in multidisciplinary areas of nanoscience
2. Understand the basic scientific concepts underpinning nanoscience
3. Understand the properties of materials at the atomic/molecular level and the scaling laws governing their properties
4. Understand the relationships and connections across the sciences and non-science disciplines that are core to nanotechnology
5. Understand the current frontier developments in nanotechnology.

UNIT – I

INTRODUCTIONTONANOTECHNOLOGY

Definition of Nano-Science and Nano Technology, Applications of Nano-Technology. Introduction to Physics of Solid State: Structure: Size dependence of properties; crystal structures, face centred cubic nanoparticles; Tetrehedrally bounded semiconductor structures; lattice vibrations. Energy Bands: Insulators, semiconductor and conductors; Reciprocal space; Energy bands and gaps of semiconductors; effective masses; Fermi Surfaces.

UNIT – II

SYNTHESIS METHODS & METHODS OF MEASURING PROPERTIES

Various nanomaterial synthesis approaches, RF plasma, sputtering, chemical methods, thermolysis, Pulsed Laser Methods.

STRUCTURE: Crystallography, particle size determination, surface structure, Microscopy: Scanning Prob Microscopy (SPM), Atomic Force Microscopy (AFM), Field Ion Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy (TEM)

SPECTROSCOPY: Infrared and Raman Spectroscopy, X-ray Spectroscopy, Magnetic resonance, Optical and Vibrational Spectroscopy, Luminescence.

UNIT – III

CARBON NANOSTRUCTURES

Carbon molecules, nature of the carbon bond, new carbon structures, Carbon nanotubes, fabrication, types, electrical, vibrational and mechanical properties, Applications of carbon nanotubes: computers, fuel cells, chemical sensors.

UNIT- IV

QUANTUM WELLS, WIRES AND DOTS

Preparation of quantum nanostructures, size and dimensionality effects, size effects, conduction electrons and dimensionality, fermi gas and density of states, potential wells, particle confinement, Properties dependent on density of states, Excitons, Single electron tunneling, Applications: Infrared detectors, Quantum dot lasers.

UNIT – V

NANOMACHINES AND NANODEVICES

Micro-electro-mechanical systems (MEMS), characteristics, Nano-electro-mechanical systems (NEMS), fabrication techniques, nanodevices and nanomachines, Molecular and supramolecular switches.

TEXT BOOKS

1. Charles P. Poole, Frank J. Owens, "Introduction to Nanotechnology", Wiley Inter Science, 2003.
2. Mark A. Ratner, Daniel Ratner, "Nanotechnology: A gentle introduction to the next Big Idea", Prentice Hall P7R:1st Edition, 2002.

REFERENCES

1. Mick Wilson, KamaliKannargare., Geoff Smith, "Nano technology: Basic Science and Emerging technologies", Overseas Press, 2005.
2. Hari Singh Nalwa, "Nanostructured Materials and Nanotechnology", Academic Press, 2002.
3. T. Pradeep, "Nano: The Essentials, Understanding of Nanoscience and Nanotechnology," Tata McGraw-Hill, 2007.
4. KarkareManasi, "Nanotechnology Fundamentals and Applications" I.K. International, 2008.

VII SEMESTER

S311 - MICRO ELECTRO MECHANICAL SYSTEMS

(Common to AE, ECE, EIE, ME)

Course Educational Objectives:

In this course student will learn about

1. Fundamentals of Micro-Electro-Mechanical-Systems and Microsystems and their examples.
2. The benefits of miniaturization and the advantages of MEMS devices
3. Scaling Laws in miniaturization, scaling in geometry, electro statistics, electromagnetic, fluid mechanics and heat transfer.
4. Fabrication process of MEMS, Bulk Micromachining: Etching-Isotropic and Anisotropic, Wet Etching and Dry Etching (Plasma, Deep reactive ion) Comparison, Surface Micromachining and LIGA Process.
5. The application of MEMS in various fields, example Biomedical Sensors, Chemical sensors, Optical Sensors, Pressure Sensors, Thermal Sensors, Micro grippers, Micro motors, Micro gears, Micro pumps.

Course Outcomes:

At the end of this course student will be able to

1. Think in a unified way about interdisciplinary Microsystems.
2. Understand the operation of a wide range of sensors and actuators appropriate for micro scale systems encompassing different energy domains.
3. Explain the technological and economical requirements that can make a micro system a commercial success and list successful examples.
4. Choose micro fabrication methods suited for the fabrication of a given micro system and explain how the various processes can be integrated.
5. Evaluate and choose transduction principles (e.g., electrostatic or magnetic) for actuation in a micro system and perform analytical calculations for a simple actuator based on them.
6. Describe, analyze and solve a concrete problem involving micro technology

UNIT – I

OVERVIEW OF MEMS:

MEMS and Microsystems definitions and examples, Difference between Microsystems and Microelectronics, Benefits of miniaturization, Applications: Industrial/automotives sensors, Medical systems, aircraft sensors, Structural health monitoring, Telecommunication etc, Materials for MEMS.

UNIT – II

SCALING LAWS IN MINIATURIZATION:

Introduction to Scaling, Scaling in Geometry, Scaling in Electrostatic forces.MEMS Design Considerations.

UNIT – III

MICRO FABRICATION –I:

Introduction, Photolithography, Photo resists and Application, Light Sources, Photo resist Removal, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition (CVD), Sputtering, Deposition by Epitaxy, Etching.

UNIT – IV

MICRO FABRICATION – II

Bulk Micromachining: Etching-Isotropic and Anisotropic, Wet Etching and Dry Etching (Plasma, Deep reactive ion) Comparison.

Surface Micromachining: Process, associated Mechanical problems (Adhesion, Interfacial stresses, Stiction), LIGA process, MEMS Packaging.

UNIT – V

MEMS DEVICES AND STRUCTURES

Micro sensors: Biomedical Sensors, Chemical sensors, Optical Sensors, Pressure Sensors, Thermal Sensors.Micro actuation: Actuation using thermal forces, Piezoelectric crystals, Electrostatic forces, MEMS with micro actuators: Micro grippers, Micro motors, Micro gears, Micro pumps.

TEXT BOOK

Tai-Ran Hsu, MEMS & Microsystems Design and Manufacture, Tata McGraw Hill.

REFERENCES

1. Marc Madou , “Fundamentals of Micro Fabrication.”, , CRC Press
2. Mohamed Gad-el-Hak , “The MEMS Handbook” , CRC Press
3. G.K.AnanthaSuresh , “Micro and Smart Systems.”, Wiley India

VII SEMESTER

S370 - RENEWABLE ENERGY SOURCES

(Common to EIE, IT, ME)

Course Educational Objectives:

1. To learn the Potential importance of renewable energy sources.
2. To learn the geothermal, Wind Energy systems.
3. To learn Critical issues related to the OTEC and Tidal Energy systems.
4. To learn power generation from Bio mass plants.
5. To learn the Direct Energy Conversion system principles.

Course Outcomes:

After the completion of course, students are able to

1. Design the various types of solar systems.
2. Develop the skills to operate and analyze geothermal energy plant.
3. Analyze the power generating capacities of Tidal, Ocean and Thermal Energy Conversion systems.
4. Design and Develop simple bio gas plants
5. Design and Develop the Direct Energy conversion systems.

UNIT - I

INTRODUCTION: Energy Scenario – Survey of Energy Resources – Classification – Need for Non-Conventional Energy Resources.

SOLAR ENERGY: The Sun - Sun-Earth Relationship –Solar radiation – Attention – Radiation measuring Instruments.

SOLAR ENERGY APPLICATIONS: Solar water Heating, Space Heating – Active and Passive heating – Energy storage – selective surface – solar stills and ponds – solar refrigeration – photovoltaic generation.

UNIT - II

WIND ENERGY: Wind – characteristics – wind energy conversion systems – types – Betz model – Interference Factor – Power Coefficient – Torque Coefficient and thrust coefficient – Lift machines and drag machines – matching – electricity generation..

GEOTHERMAL ENERGY: Structure of Earth – Geothermal Regions – Hot springs – Hot Rocks – Hot Aquifers – Analytical Methods to estimate Thermal Potential – Harnessing Techniques – Electricity Generation Systems.

UNIT - III

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 - IV

BIO – ENERGY: Biomass Energy Sources – Plant Productivity, Biomass Wastes – Aerobic and Anaerobic bio-conversion processes – Raw Materials and properties of Bio-gas-

Bio-gas plant Technology and Status – The Energetic and Economics of Biomass systems – Biomass gasification

UNIT - V

DIRECT ENERGY CONVERSION SYSTEMS: Introduction to direct energy conversion systems, Peltier effect, seebeck effect, Thomson effect, Fuel Cells, efficiency of Fuel Cells, and Solar Cells–Thermionic and Thermoelectric Generation – MHD Generator-Open and Closed Systems, applications of direct energy energy conversion systems.

TEXTBOOKS

1. G.D.Rai, Non-Conventional Energy Sources, 5th Edition 2011, Khanna Publishers, New Delhi, India.
2. Kreith, F and Kreider, J. F., Principles of Solar Engineering, McGraw-Hill, 1978.

REFERENCES

1. John Twidell&Tony Weir, Renewable Energy Resources – 2nd Edition ,Taylor & Francis
2. Malcolm Flesher &ChrrisLawis Biological Energy Resources – Routledge Publishers
3. G.N.Tiwari, Solar Energy – Fundamentals, Design, Modelling and Applications – Narosa Publication Ltd.,2000.
4. Ashok V Desai, Non-Conventional Energy- Wiley Eastern, 2000.
5. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K, 1996.
6. Veziroglu, T.N., Alternative Energy Sources, Vol 5 and 6, McGraw-Hill, 1990
7. Khandelwal K.C, Mahdi S.S., Biogas Technology - A Practical Handbook, Tata McGraw Hill

VII SEMESTER

S357 - PROJECT MANAGEMENT

(Common to EEE, ME)

Prerequisite Subject: Estimation, Costing and Engineering Economics

Course Educational Objectives:

The objective of this course is to :

1. Create awareness about project management concepts.
2. Discuss the various methods and approaches for project management.
3. Discuss the concepts of PERT, CPM techniques.
4. Discuss various factors involved in risk management.
5. Illustrate various costs - estimating & budget tools

Course Outcomes:

After completion of the course student will be able to:

1. Apply concepts of PM in managing the product life cycle.
2. Formulate, plan, schedule and control the projects effectively.
3. Manage risks while handling the projects.
4. Perform financial planning of the project.
5. Design effective projects using PERT & CPM techniques.

UNIT – I

INTRODUCTION TO PROJECT MANAGEMENT

Definition, functions, evolution of Project Management, classification of projects, Project Management in different environments

THE PROJECT MANAGEMENT SYSTEMS, METHODOLOGIES & SYSTEMS DEVELOPMENT CYCLE: Systems approach, systems analysis, systems development, project feasibility, project life cycle, project appraisal, project contracting, the phases of systems development cycle.

UNIT – II

PROJECT FEASIBILITY STUDY

Developing a project plan, market & technical analysis, financial analysis, evaluation of project proposals, risk analysis, sensitivity analysis, social cost benefit analysis; Project Planning: Planning fundamentals, project master plan, work breakdown structure & other tools of project planning, work packages project organization structure & responsibilities.

UNIT – III

PROJECT SCHEDULING

Use of Gantt Charts & network diagrams, activity of node diagrams, activity on arrow diagrams, the critical path, time based networks PERT, CPM, Resource Allocation & GERT: Tools & techniques for scheduling development, crashing of networks, time cost relationship, resource leveling multiple project scheduling, GERT

UNIT – IV

COST ESTIMATING & BUDGETING

Cost estimating process elements of budgeting, project cost accounting & management information systems, cost schedules & forecast

UNIT – V

MANAGING RISKS IN PROJECTS

Risk concept & identification, risk assessment, risk priority, risk response planning, risk management methods; Project Control**:** Information monitoring, internal & external project control, cost accounting systems for project control, control process, performance analysis, variance limits, and issues in project control.

TEXT BOOK

1. Nicholas, John M., "Project Management for Business & Technology (Principles & Practice)", Pearson Education

REFERENCES

1. Prasanna Chandra, "Projects: Planning, Analysis, Selection, Implementation & Review", 7th edition, Tata McGraw Hill 2009.
2. Shtub, Bard and Globerson, "PROJECT MANAGEMENT, Engineering, Technology and Implementation", Prentice Hall, India
3. P.K.JOY, "Total Project Management, the Indian Context", Macmillan India Ltd. N.J.Smith(Ed), "Project Management", Blackwell Publishing, 2002.

VII SEMESTER

L117 - CAD / CAM LAB

Prerequisite Subject: CAD/CAM

Course Educational Objectives: To familiarize the students with

1. Modeling and assembly of part bodies using graphic packages.
2. Analysis of modeled parts.
3. Finite element analysis of given continuum.
4. Part programming and machining on CNC Machines.
5. Robotic programming, simulation and execution.

Course Outcomes:
After completion of the lab students are able to:

1. Design and assemble of the parts using geometric modeling.
2. Perform kinematic and interference analysis.
3. Apply FEA principles in designing of components.
4. Develop NC code for different part profiles and perform machining on CNC Machines.
5. Manipulate the robot by writing programs and executing them.

LIST OF EXPERIMENTS

1. AssemblyModeling (At least three examples)
2. Analysis of trusses
3. Analysis of Beams
4. Plane stress, plane strain analysis
5. Analysis of Axi-symmetric solids
6. Analysis of 3D solids
7. Estimation of natural frequencies and mode shapes for simple problems
8. Steady state heat transfer Analysis
9. Development of NC code using CAM packages
10. Machining of simple components on NC lathe and Mill by transferring NC Code /from a CAM package
11. Machining of Simple components on NC-Mill by transferring NC Code/from a CAM Package
12. Robot programming, simulation and execution.

SOFTWARE PACKAGES
ANSYS/NASTRAN /CATIA /ProE/ Iron CAD etc.

REFERENCE
Lab Manuals

VII SEMESTER

L160 - METROLOGY AND INSTRUMENTATION LAB

Prerequisite Subject: METROLOGY & INSTRUMENTATION

Course Educational Objectives:

The objectives of this course are to:

1. Learn the main principle on which different instruments operate and provide hands on experience on them.
2. Generate knowledge and skill in use of precision instruments.
3. Learn a basic understanding of various instruments used in linear and angular measurements.
4. Get familiarize with usage of tool makers microscope.
5. Learn a basic understanding of the instruments used for measurement of pressure, temperature, flow etc.

Course Outcomes:

After completion of the course student will be able to:

1. Develop quality standards of engineering products in industries.
2. Demonstrate work in quality control departments of industries and to ensure quality of products.
3. Analyze the measurement of the surface roughness and perform alignment tests.
4. Develop the ability to apply the principles in instruments and measuring techniques.
5. Demonstrate work in designing the instrumentation for a particular purpose and special purpose devices.

PART-A: METROLOGY

At least five experiments may be conducted.

1. Measurement of lengths, heights, diameters by vernier calipers and micrometers.
2. Measurement of bores by dial bore indicators.
3. Taper measurement by using balls and rollers.
4. Use of gear teeth vernier calipers and checking the chordal addendum and chordal height of spur gear.
5. Machine tool alignment of test on the lathe or milling machine.
6. Measurement of screw thread parameters using Tool makers microscope.
7. Angle and taper measurements by Bevel protractor, Sine bars, etc.
8. Thread measurement by three wire method.
9. Surface roughness measurement by Taly Surf.

PART-B: INSTRUMENTATION

At least five experiments may be conducted.

1. Calibration of Pressure Gauges
2. Study and calibration of LVDT transducer for displacement measurement.
3. Calibration of strain gauge for load measurement.
4. Calibration of capacitive transducer for linear displacement.
5. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
6. Study and calibration of a rotameter for flow measurement.
7. Study of Piezo-electric transducer.
8. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
9. Study and calibration of McLeod gauge for low pressure.

REFERENCE

LAB MANUALS

VIII SEMESTER

S343 - POWER PLANT ENGINEERING

Prerequisite Subject: Thermal Engineering and ICGT

Course Educational Objectives:

1. To learn about features and performance of a thermal power plant cycle
2. To learn about diesel engine and gas turbine power plants.
3. To learn about the hydroelectric and nuclear power plants.
4. To learn about nonconventional power plants.
5. To learn the procedure of power tariff calculations and economics of power generations.

Course Outcomes:

After completion of the course students are able to :

1. Develop awareness on different types of power generation systems.
2. Differentiate conventional and non conventional power plants.
3. Distinguish between polluting and non polluting power plants.
4. Acquire knowledge on the economic viability of various power generation systems.
5. Apply the power plant engineering concepts practically in developing low cost systems.

UNIT - I

INTRODUCTION: Various Energy sources-Types of power plants-Resources and Development of Power in India.

STEAM POWER PLANT: Plant Layout-Working of Different circuits-Types of Coal-Coal handling systems--Coal storage- Overfeed and underfeed fuel beds-Pulverized Fuel burning system -Ash handling systems-Dust collection and its disposal-Mechanical type -Electrostatic Precipitator-Cooling Towers and heat rejection.

UNIT - II

DIESEL POWER PLANT: Plant layout with auxiliaries-Fuel storage and Fuel supply system-Air supply system-Exhaust system-Water cooling system-Lubrication system-Starting system-Supercharging-Advantages and Disadvantages of Diesel plants over Thermal plants.

GAS TURBINE PLANT: Introduction-Classification-Layout with auxiliaries-Principles of working of Closed and Open cycle gas turbines-Combined cycle power plants and comparison.

UNIT - III

HYDRO ELECTRIC POWER PLANT: Hydrology-Hydrological cycle- Rainfall- Run off Hydrograph- Flow duration curve- Mass curve--Site selection of hydro plant-Typical layout-Different types of hydro plants.

NUCLEAR POWER PLANT: Nuclear Fission and Fusion - Nuclear Fuels- Breeding-Components of Reactor-Types of Nuclear Reactors-Pressurized water reactor(PWR)-Boiling water reactor(BWR)-CANDU reactor-Gas cooled reactor-Liquid metal cooled reactor-Fast Breeder Reactor-Nuclear waste and its Disposal.

UNIT - IV

POWER FROM NON-CONVENTIONAL SOURCES: Solar power plants-Utilization of Solar collectors-Principle of working of Wind energy-Types- Tidal Energy.

DIRECT ENERGY CONVERSION SYSTEM: Solar cell- Fuel cell-Thermo Electric and Thermo ionic conversion system-MHD generation.

UNIT - V

POWER PLANT ECONOMICS: Fixed cost-Operating cost.-Fluctuating loads-General arrangement of Power Distribution-Load curves-Load duration curve- Connected load-Maximum demand-Demand factor-Average load-Load factor-Diversity factor- Plant capacity factor**.**

POLLUTION AND CONTROL: Introduction- Particulate and gaseous pollutants-Air and Water pollution by Thermal plants and its control—Acid rains -Methods to control pollution.

TEXT BOOKS

1. P.K.Nag, Power Plant Engineering, , 3rd Edition ,2008 TMH, New Delhi
2. Arora&Domkundwar, A course in Power Plant Engineering- DhanpatRai&Company 5th Revised Reprint Edition, 2004

REFERENCES

1. R.K.Rajput, A Text book of Power Plant Engineering, Laxmi Publications ,2nd Edition 2001
2. P.C.Sharma, Power Plant Engineering, 9th Revised & Reprint Edition 2012 S.K.Kataria&sons
3. M.M.ElWakil, Power plant technology, 3rd Edition 2010 TMH.
4. G.R.Nagpal, Power plant engineering, Khanna Publishers.14th Edition 2000.

VIII SEMESTER

S109 - ADVANCED STRENGTH OF MATERIALS

Prerequisite Subject: Mechanics of Materials

Course Educational Objectives:

The objective of the course is to

1. Familiarize the concepts of shear center and unsymmetrical bending
2. Learn the continuous beam problems and curved beams
3. Familiarize the concept of torsion and rotating disc of uniform strength
4. Acquire the knowledge columns subjected to eccentric axial loads
5. Learn concept of contact stresses.

Course Outcomes:

After completion of the course student will be able to:

1. Develop an approximate solution for the location of shear centre..
2. Analyze the torsion problems of circular cross section.
3. Analyze the local buckling of thin wall flanges of elastic columns
4. Apply the knowledge of curved beams in the field of engineering.
5. Analyze the maximum principle and shear contact stresses between two ideal elastic bodies

UNIT - I

SHEAR CENTER AND UNSYMMETRICAL BENDING: Bending axis and shear center – Shear center for axi-symmetric and unsymmetrical sections – Bending stresses in beams subjected to non-symmetrical bending – Deflection of straight beams due to non-symmetrical bending.

UNIT - II

CURVED BEAM THEORY: Introduction – Stresses in curved beams – Winkler Bach theory – Limitations - Design of crane hooks– Closed ring subjected to concentrated and uniform loads.

CONTINUOUS BEAMS: Clapeyron's theorem of three moments – Beams with constant and varying moment of inertia.

UNIT - III

TORSION: St.Venant's approach - Prandtl approach – Membrane analogy – Torsion of thin walled open and closed sections.

CENTRIFUGAL STRESSES: Introduction – Rotating ring – Rotating disc- Rotating disc of uniform strength.

UNIT - IV

COLUMNS: Buckling and stability – Columns with pinned ends – Columns with other support conditions -Limitations of Euler's formula – Rankin's formula – Columns with eccentric axial loads – Secant formula.

UNIT - V

THIN WALLED PRESSURE VESSELS: Circumferential and longitudinal stresses – Riveted cylindrical boilers –Wire bound thin pipes – Cylinder with hemispherical ends.

CONTACT STRESSES: Methods of computing stress – Deflection of bodies in point and line contact applications.

TEXT BOOKS

1. Boresi& Sidebottom Advanced Mechanics of Materials, 6th Edition- Wiley International.
2. L.S.Srinath, Advanced Mechanics of Solids, Tata McGraw Hill

REFERENCES

1. Dr. Sadhu Singh, Strength of Materials, Khanna Publishers
2. Gere and Timoshenko, Mechanics of Materials, CBS Publishers & Distributers
3. Seely and Smith, Advanced Mechanics of Materials, John Wiley International Edn.

VIII SEMESTER

S165 - COMPUTATIONAL FLUID DYNAMICS

Prerequisite Subject: Fluid Mechanics and Heat Transfer

Course Educational Objectives:

1. To learn the elements of computational methods of fluid flow
2. To learn about the application of CFD to different fields of engineering
3. To learn the flow fields and the behaviour of fluid, combustion etc.,
4. To learn to get the solutions to the complicated problems by using the techniques of CFD
5. To learn the Finite difference equations in Heat Transfer

Course Outcomes:

After completion of the course student will be able to:

1. Acquire the ability to visualize the CFD techniques for the fluid flow fields of combustion chamber of IC engines and consequently analyze the behaviour of fluid.
2. Know the effects of important parameters on the performance and efficiency of the system.
3. Carry out the simulation studies for various thermal systems.
4. Know the importance of the simulation studies where there is no scope for carrying out the experimental work.
5. Attempt to improve the performance and efficiency of thermal systems based on the simulation results.

UNIT - I

INTRODUCTION: Computational Fluid Dynamics as a Research and Design Tool, Applications of Computational Fluid Dynamics

GOVERNING EQUATIONS OF FLUID DYNAMICS: Introduction, Control Volume, Substantial Derivative, Divergence of Velocity, Continuity Equation, Momentum Equation and Energy Equation

UNIT - II

MATHEMATICAL BEHAVIOR OF PARTIAL DIFFERENTIAL EQUATIONS: Introduction, Classification of Quasi-Linear Partial Differential Equations, Eigen Value Method, Hyperbolic Equations, Parabolic Equations, Elliptic Equations

UNIT - III

BASICS ASPECTS OF DISCRETIZATION: Introduction, Introduction of Finite Differences, Difference Equations, Explicit and Implicit Approaches, Errors and Stability Analysis, Grid Generation

UNIT - IV

INCOMPRESSIBLE FLUID FLOW: Introduction, Implicit Crank-Nicholson Technique, Pressure Correction Method, Computation of Boundary Layer Flow

UNIT - V

HEAT TRANSFER: Finite Difference Applications in Heat conduction and Convention – Heat conduction, steady heat conduction, in a rectangular geometry, transient heat conduction, Finite difference application in convective heat transfer.

TEXT BOOK

1. John. D. Anderson, Computational fluid dynamics - Basics with applications - McGraw Hill.

REFERENCES

1. Anderson, D.A.,Tannenhill, I.I., and Pletcher, R.H.,Taylor and Francis Computational Fluid Mechanics and Heat Transfer
2. Suhas V. Patankar, Numerical heat transfer and fluid flow - Butter-worth Publishers
3. T. K Sengupta, Fundamentals of Computational Fluid Dynamics, University Press

VIII SEMESTER

S365 - RAPID PROTOTYPING

Prerequisite Subject: CAD/CAM

Course Objective: The objectives of the course are :

1. To familiarize students with principles and application of rapid prototyping.
2. Understand the concepts of solid based and power based rapid prototyping systems.
3. Learn the basic concepts of rapid tooling elements.
4. Get familiarized with data formats and software.
5. Understand the basic concept of reverse engineering.

Course Outcomes:

After completion of the course student will be able to:

1. Apply rapid prototyping techniques in developing various products.
2. Differentiate between solid based and powder based rapid prototyping.
3. Suggest a particular rapid tool for a product.
4. Use the software in designing the product.
5. Apply reverse engineering concepts for developing products.

UNIT-I

INTRODUCTION: Prototype, Historical Development, Fundamentals of Rapid Prototyping, Advantages of Rapid Prototyping, Applications, Commonly Used Terms, Classification of RP System. Rapid Prototyping Process Chain: Process Chain, Data Conversion and Transmission, Checking and Preparing, Building, Post processing.

LIQUID BASED RAPID PROTOTYPING SYSTEMS:

Principle of operation, process details, data preparation, data files, machine details and applications - Stereo lithography Apparatus (SLA), Solid Ground Curing (SGC)

UNIT-II

SOLID BASED RAPID PROTOTYPING SYSTEMS: Principle of operation, process details, data preparation, data files, machine details and applications - Laminated Object Manufacturing (LOM), Fused Deposition Modeling (FDM),Paper Lamination Technology (PLT)

POWDER-BASED RAPID PROTOTYPING SYSTEMS: Principle of operation, process details, data preparation, data files, machine details and applications - Selective Laser Sintering (SLS), Three- Dimensional Printing (3DP), Laser Engineered Net Shaping (LENS), Direct Shell Production Casting (DSPC).

UNIT-III

RAPID TOOLING: Indirect Rapid tooling - Silicon rubber tooling - Aluminium filled epoxy tooling Spray metal tooling, Cast kirksite, 3D keltool; Direct Rapid Tooling - AIM, Quick cast process, Copper Polyamide, Rapid Tool, DMILS, Pro Metal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling.

UNIT-IV

RAPID PROTOTYPING DATA FORMATS AND SOFTWARE:

STL Format, STL File Problems, Consequences of Building a Valid and Invalid,Tessellated Model, Overview of Solid view, magic's, mimics, magic communicator.Collaboration tools, Rapid Manufacturing Process Optimization: factors influencing accuracy, data preparation errors, Part building errors, Error in finishing, influence of build orientation.

UNIT-V

REVERSE ENGINEERING:

Meaning and uses of RE, Relationship between Reverse Engineering and Rapid Prototyping, Legal Aspects of Reverse Engineering. The generic processes of RE, Phase 1– scanning, Contact Scanners, Noncontact Scanners, Phase 2–Point Processing, Phase 3–Application Geometric Model Development, Reverse Engineering–Hardware and Software. METHODOLOGIES and Techniques for Reverse Engineering:

Computer Vision and Reverse Engineering, Coordinate Measuring Machines, ActiveIllumination 3-D Stereo, Data Collection, Mesh Reconstruction, Surface Fitting. Integration of reverse engineering and rapid prototyping.

TEXT BOOKS

1. Chua, C. K., K. F. Leong and C. S. Lim, 2003, Rapid Prototyping: Principles and Applications, World Scientific, River Edge, NJ.
2. AmitabhaGhosh, 1997, Rapid Prototyping - A Brief Introduction, Affiliated East West Press Pvt. Ltd.

REFERENCES

1. Peter D. Hilton, Hilton/Jacobs, Paul F. Jacobs, Rapid Tooling: Technologies and Industrial Applications, CRC press, 2000.
2. Ali K. Kamrani, EmadAbouel Nasr, Rapid Prototyping: Theory and practice, Springer, 2006.
3. Liou W. Liou, Frank W. Liou, Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press, 2007
4. Ingle Kathryn A., Reverse Engineering, McGraw Hill Publication

VIII SEMESTER

S353 - PRODUCTION PLANNING AND CONTROL

Prerequisite Subject: Industrial Management and Operation Research

Course Educational Objectives:

The objectives of the course are to

1. Understand the basic concepts of production planning and control.
2. Familiarize with different forecasting techniques.
3. Familiarize the concepts of inventory management.
4. Understand the concepts of routing and scheduling.
5. Acquire basic knowledge in aggregate planning, expediting and follow up.

Course Outcomes:

After completion of the course student will be able to:

1. Exhibit the ability in developing production planning for operating economy, effectiveness and cost control.
2. Apply the forecasting techniques in estimating the number of products.
3. Use the inventory management techniques to determine the optimum quantity of material.
4. To develop the route sheet required for a production process/activities.
5. To decide the dispatch procedure required for a production processes and other activities.

UNIT - I

INTRODUCTION: Definition – Objectives of Production Planning and Control – Functions of production planning and control – Elements of production control – Types of production – Organization of production planning and control department – Internal organization of department.

UNIT - II

FORECASTING– Objectives and Importance of forecasting – Types of forecasting, forecasting techniques-simple moving average method, weighted moving average method, exponential smoothing method, linear regression and Delphi method. Errors in forecasting-MAD, MSE, MAPE, MFE.

UNIT - III

INVENTORY MANAGEMENT – purpose of inventories – relevant inventory costs, EOQ model and assumptions in EOQ.ABC analysis – VED analysis.Inventory control systems – P–Systems and Q-Systems. Introduction to MRP, inputs to MRP, Bill of material, JIT inventory-Kanban system.

UNIT - IV

ROUTING –Routing procedure –Route sheets– Factors affecting routing.Scheduling – definition – Difference with loading, Scheduling and loading guidelines, Standard scheduling methods-forward scheduling and backward scheduling.Johnson's rules.

UNIT - V

Aggregate planning and aggregate planning strategies, Expediting, controlling aspects. Dispatching – Activities of dispatcher – Dispatching procedure, Documents maintained by dispatching department – folowup – definition – Reason for existence of functions – types of followup, applications of computer in production planning and control.

TEXT BOOKS

1. R.Pannerselavn, Production and Operations Management, 2nd Edition, PHI,2007.
2. P.Rama Murthy, Production and Operations Management, New Age Internationa, 2ndEdition, 2005

REFERENCES

1. S.N.Chary, Production and Operations Management, TMcH, 4th Edition 2010.
2. SamuelEilon, Elements of Production Planning and Control, Universal Publishing Corporation, 2004
3. Seetharama L.N, Production Planning and Inventory Control, PHI, 2nd Edition1995

VIII SEMESTER

S158 - COGNITIVE ENGINEERING

Prerequisite Subject: Work Study and Ergonomics

Course Educational Objectives:

The objective of this course is to:

1. Underline the importance of Cognitive usability concepts.
2. Discuss the application of scientific research in system and product design.
3. Create awareness about concepts of Cognitive Engineering.
4. Illustrate various stages in product design.
5. Describe the concepts of human centered design.

Course Outcomes:

After completion of the course students are able to:

1. Differentiate between human perceptual and cognitive limitations.
2. Apply quantitative models of perception and cognition to analyse human performance.
3. Design equipment, products, and tasks that address human perceptual and cognitive limitations.
4. Design appropriate experiments to determine human perceptual limitations.
5. Distinguish the cognitive limitations and capabilities required for designing a product or process.

UNIT - I

INTRODUCTION

Introduction to Cognitive Engineering, Fundamental issues in Cognitive Engineering, Information, Computation, Representation.

UNIT - II

MEMORY MODELS

Three Stage memory model, Sensory memory: the sperling experiment, short-term memory: Jacob's experiment, Chucks, Long term memory; Ebbing Hans Forgetting Curve; Tulvings long term memory model, memory retrieval.

UNIT - III

STAGES IN DESIGN

The seven stages of action, Gulf of Execution and Gulf of Evaluation, Basic design principles, Visibility, A good conceptual model, good mapping, feed back

UNIT - IV

MENTAL MAPPING

Physical constraints, semantic constraints, cultural constraints, logical constraints affordances, Natural Mapping, The problem with switches, grouping problem, mapping problem, Visibility and feedback, the structure of tasks, simplifying the structure of tasks.

UNIT - V

USER- CENTRED DESIGN

Use of both knowledge in the world and the head; simplifying the structure of tasks, make things visible, bridge the gulf of execution and the gulf of evaluation, get the mapping right, exploit the power of constraints, Design for errors, Case studies of Cognitive Engineering.

TEXT BOOK

1. Posner,M.I ,Foundations of Cognitive Science, , MIT Press,2010

REFERENCES

1. Bechtel,W.&Graham,G ,A Companion to Congnitive Science, , Blackwell publishing,2006
2. Sharp,R.P, Interaction design beyond human, wiley publishers,2003.

VIII SEMESTER

S306 - MECHATRONICS

Prerequisite Subject: Robotics

Course Educational Objectives: To familiarize the students about:

1. Frame of reference on mechatronic systems and system response.
2. Emphasis of signal conditioning in manipulation of analog signals.
3. Distinctive mechanical sensors for the measurement of physical quantities.
4. Overview of Distinctive actuating systems Microcontrollers.
5. Performance of Programmable Motion Controllers in Various fields

Course Outcomes:

After completion of the course students are able to:

1. Implement the mechatronic systems in various industrial fields.
2. Apply Signal conditioning in sensors for more accurate measurements.
3. Measure various physical quantities using sensors.
4. Implement actuators and Microcontrollers in Automobile engine control systems and robotics.
5. Integrate programmable motion controllers with Automation, Aerospace and Robotic fields.

UNIT-I

INTRODUCTION TO MECHATRONICS: Definition of mechatronics-components of mechatronics-example of mechatronic system-elements of measurement systems.

SYSTEM RESPONSE: System response-measurement system input-output-dynamic characteristics of systems: zero order system-first order system – second order system-step response of second order system (Under damped, critically damped and over damped).

UNIT-II

SYTEM MODELLING: System modelling and analogies: Relationship between Mechanical system-Translational and rotational-Electrical (current and voltage)-Electromechanical systems-hydraulic mechanical system.

SIGNAL CONDITIONING & DAQ: Signal Conditioning-OPAMP-filtering-Wheatstone bridge-Quantizing theory-Analog to Digital Conversions (ADC)-Digital to Analog Conversions (DAC)-Virtual Instrumentation, DAQ and control.

UNIT-III

SENSORS:POSITION AND SPEED MEASUREMENT: Proximity, potentiometer-LVDT-Optical Encoder.

STRESS AND STRAIN MEASUREMENT: Measurement of Resistance with Wheatstone bridge-measurement of stress with strain gauges-load cells.

TEMPERATURE MEASUREMENT: Thermometer, Thermister, RTD-Thermocouple. Vibration and acceleration measurement.Pressure and flow measurement.Semiconductor sensors and Micro Electro Mechanical Devices.

UNIT-IV

MECHANICAL & ELECTRICAL ACTUATION SYSTEMS: Electromagnetic principles-Solenoids and relays-Electric motors-DC motors- servomotors-stepper motor-Hydraulics valves-actuators –Pneumatics-Gear trains-clutches-brakes-bearings

INTRODUCTION TO MICROCONTROLLERS: Difference between Micro Processors and microcontrollers –Intel 8051 block diagram and pin diagram-applications –languages used in MC.

INTERFACING MICROCONTROLLER WITH ACTUATORS:

Interfacing-interfacing requirements –serial interfacing and parallel interfacing-Interfacing with seven segment display with decoder-Interfacing with relays- with solenoids- with sensors-interfacing with stepper motors-interfacing with DAC's.

UNIT-V

CONTROLLERS: P, PI, And PID: Continuous and discrete process-controller Modes-ON-OFF-Proportional-Integral-Derivative -PID controller-digital controller.

PLC: Programmable Logic Controller-advantages of PLC's-basic structure of PLC's-input-output-forms of PLC's-Input output processing-Ladder programming –logic functions-instructions-internal relays-operation of timers and counters (briefly)-advantages of PLC over other controllers.

TEXT BOOKS

1. W.Bolton Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering ,Pearson Education Press, 3rd Edition, 2005.
2. M.D.Singh/J.G.Joshi ,Mechatronics, PHI,1st edition, 2006.

REFERENCES

1. Newton C Braga ,Mechatronics Source Book , Thomson Publications, Chennai,1st edition,2003.
2. N. Shanmugam / Anuradha, Mechatronics Agencies Publisers,1stEdition,2001.
3. Devdasshetty/Richard ,Mechatronics System Design ,Thomson,cengage learning, 2ndEdition,2010.

VIII SEMESTER

S273 - INNOVATION AND ENTREPRENEURSHIP

Prerequisite Subject: Industrial Management

Course Educational Objectives:

1. To understand the nature of entrepreneurship.
2. To motivate the Entrepreneurial instincts.
3. To give a clear picture about the process and involved in setting up an small scale industrial settings and bigger settings.
4. To make the potential entrepreneurs know about the possible risks and failures of the product make them learn how to overcome these problems
5. To make students understand the importance of innovation, which would be helpful to have an edge over all other competitors

Course Outcomes:

After completion of the course student will be able to:

1. Can develop various business related skills like marketing, quality management, production, distribution and human resource management etc.
2. Will be able to startup and handle the own enterprise.
3. Will be able to develop team building, planning skills and above all broad vision about the business.
4. Would be in a position to convert and innovative thought into a commercial opportunity, which can boost up the economy.

UNIT-I

CREATIVITY AND INNOVATION: Concepts, shifting, composition of the economy, purposeful innovation and seven sources of innovative opportunity, the innovation process. Innovative strategies: strategies that aim at introducing an innovation. Innovation and entrepreneurship: can they work together? Planning – incompatible with innovation and entrepreneurship

UNIT -II

INTRODUCTION TO ENTREPRENEURSHIP: Definition of Entrepreneur, Entrepreneurial Traits, Traditional entrepreneurship vs Modern Entrepreneurship, Entrepreneur vs. Manager, Entrepreneur vsIntrapreneur. The Entrepreneurial decision process.Role of Entrepreneurship in Economic Development, Ethical, Environmental challenges and Social responsibility of Entrepreneurs.Opportunities for Entrepreneurs in India and abroad.Woman as Entrepreneur.

UNIT - III

CREATING AND STARTING THE VENTURE: Sources of new Ideas, Generation of new entry Opportunity, Opportunity Analysis, creating, problem solving, product planning and development process. SWOT Analysis; first-Mover advantages and disadvantagesTypes of business organizations, Features and evaluation of joint ventures, acquisitions, merges, franchising.

UNIT - IV

THE BUSINESS PLAN, FINANCING AND MANAGING: Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, Using and implementing business plans. Marketing plan, Introduction to financial plan and the organizational plan, Assessment of Benefits and Costs Government grants and Subsidies Launching formalities. ; Survival and Success Sources of capital, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls.E-commerce in Entrepreneurship, Internet advertising.

UNIT - V

PRODUCTION AND MARKETING MANAGEMENT: Thrust of production management, Selection of production Techniques, plant utilization and maintenance, requirements at work place, materials management. Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing.

TEXT BOOKS

1. Hisrich : Entrepreneurship, TMH,New Delhi, 2009
2. by Martin M.J ,"Managing innovation and entrepreneurship in technology based firm",. John Wiley publishers,1994,

REFERENCES

1. Vasantha Desai ,Entrepreneurship, TMH,New Delhi, 2009
2. Rajeev Roy: Entrepreneurship, Oxford University Press, New Delhi,2010
3. V.Gangadhar, Narsimha Chary: Entreprenuership Development, Kalyani Publishers, New Delhi, 2007
4. P.Narayana Reddy: Entrepreneurship. Cengage learning, New Delhi,2010

VIII SEMESTER

S409 - TOTAL QUALITY MANAGEMENT

Prerequisite Subject: Production Planning and Control

Course Objectives:

The objective of this course is to:

1. Underline the significance of Quality Management in industries.
2. Describe the principles of Quality control and business models.
3. Illustrate various statistical process control tools required for the industry.
4. Discuss various quality control models and their applications.
5. Create awareness about quality systems methodology for its implementation.

Course Outcomes:

After completion of the course students are able to:

1. Apply the principles of quality control.
2. Use quality management methods for analyzing and solving problems of organization.
3. Design efficient systems.
4. Apply the principles of Taguchi techniques to the industrial needs.
5. Implement quality system standards in the organizations.

UNIT - I

INTRODUCTION: Evolution of total quality management, Definition of Quality, Quality costs, Quality Council, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT - II

TQM PRINCIPLES: Customer satisfaction- Types of Customers, customer supply chain, customer perception of quality, customer feedback, customer retention, Service quality. Employee Involvement, Motivation, Maslow's hierarchy of needs, Herzberg theory, Empowerment and Team work, Performance appraisal, Benefits, Continuous process improvement- Juran Trilogy, PDSA cycle, 5S, Kaizen, Supplier Partnership- Partnering, sourcing, supplier selection, Performance Measures-Basic Concepts, Strategy, Performance Measure.

UNIT - III

STATISTICAL PROCESS CONTROL : The seven tools of quality, Statistical Fundamentals, Population and Sample, Normal curve, Control charts for variables and attributes, Process capability, Concepts of six sigma, New seven Management tools.

UNIT - IV

TQM TOOLS : Benchmarking, Benchmarking Process, Quality Function Deployment (QFD), House of Quality, QFD Process, Taguchi Quality Loss Function, Total Productive Maintenance-Concept, improvement needs, FMEA- Stages of FMEA.

UNIT - V

QUALITY SYSTEMS: Need for ISO 9000 and other Quality systems, ISO 9000:2000 Quality System, Implementation of Quality system, Documentation, Quality Auditing, TS 16949, ISO 14000- concepts.

TEXT BOOK

1. Dale H. Besterfiled, et al., Total Quality Management, Pearson Education, 3rd Edition 2010.

REFERENCES

1. James R. Evans & William M. Lidsay, The Management and Control of Quality, South-Western (Thomson Learning), 2002.
2. Feigenbaum.A.V, Total Quality Management, MCGraw-Hill, 2005.
3. Narayana V. and Sreenivasan, N.S, Quality Management- Concepts and Tasks, New Age International, 2006.
4. Zeiri, Total Quality Management for Engineers, Wood Head Publishers, 2009.