LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING

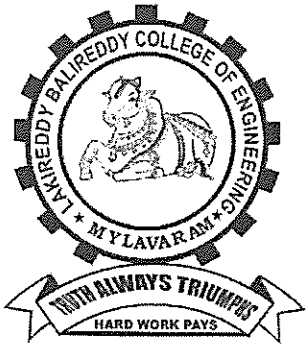
(AUTONOMOUS)

(Approved by AICTE, Affiliated to JNTUK, Accredited by NBA, ISO 9001 : 2008 Certified & Accredited by **NAAC with "A" Grade)**

B.TECH. FOUR YEAR DEGREE COURSE

(Applicable for the batches admitted from 2011-12)

MECHANICAL ENGINEERING



L.B.Reddy Nagar :: Mylavaram – 521 230 :: Krishna District
ANDHRA PRADESH STATE

COURSE STRUCTURE(2011-2012 Admitted Batch)

I-SEMESTER

Code No.	Name of the Course	Scheme of Instruction			Scheme of Examination		Total	Credits
		Periods per Week			Maximum Marks			
		Lectures	Tutorial	Lab	Internal	External		
T118	Applied Mathematics-I	4	1	--	25	75	100	4
T131	C Programming	4	1	--	25	75	100	4
T197	English-I	4	--	--	25	75	100	3
T264	Numerical Methods	4	1	--	25	75	100	4
T192	Engineering Graphics	2	--	5	25	75	100	4
P806	C Programming Lab	--	--	3	25	75	100	2
P812	Computer Aided Engineering Graphics	-	-	3	25	75	100	2
P831	Engineering Workshop	--	--	3	25	75	100	2
	TOTAL	**18**	**3**	**14**	**200**	**600**	**800**	**25**

II-SEMESTER

Code No.	Name of the Course	Scheme of Instruction			Scheme of Examination		Total	Credits
		Periods per Week			Maximum Marks			
		Lectures	Tutorial	Lab	Internal	External		
T119	Applied Mathematics- II	4	1	-	25	75	100	4
T198	English – II	4	-	-	25	75	100	3
T191	Engineering Chemistry	4	-	-	25	75	100	3
T193	Engineering Mechanics-I	4	1	-	25	75	100	5
T195	Engineering Physics	4	1	-	25	75	100	4
P832	English Language Communication Skills Lab	-	-	3	25	75	100	2
P830	Engineering Physics and Chemistry Lab	-	-	3	25	75	100	2
P845	Lab view	-	-	3	25	75	100	2
P856	Mini Project	--	--	2	25	25	50	2
	TOTAL	**20**	**3**	**11**	**225**	**625**	**850**	**27**

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III - SEMESTER

Code No.	Name of the Course	Scheme of Instruction Periods per Week			Scheme of Examination Maximum Marks		Total	Credits
		Lectures	Tutorial	Lab.	Internal	External		
T194	Engineering Mechanics-II	4	1	-	25	75	100	4
T330	Thermodynamics	4	1	-	25	75	100	4
T319	Strength of Materials	4	1	-	25	75	100	4
T250	Metallurgy & Material Science	4	-	-	25	75	100	4
T177	Electrical & Electronics Engineering	4	1	-	25	75	100	3
T241	Machine Drawing	6	-	-	25	75	100	4
P877	Strength of Materials & Metallurgy Lab	-	-	3	25	75	100	2
P821	Electrical & Electronics Lab	-	-	3	25	75	100	2
P870	Seminar - I	-	-	1	50	-	50	1
	TOTAL	**26**	**04**	**07**	**250**	**600**	**850**	**28**

IV - SEMESTER

Code No.	Name of the Course	Scheme of Instruction Periods per Week			Scheme of Examination Maximum Marks		Total	Credits
		Lectures	Tutorial	Lab.	Internal	External		
T289	Production Technology	4	-	-	25	75	100	4
T234	Kinematics of Machines	4	1	-	25	75	100	4
T204	Fluid Mechanics	4	1	-	25	75	100	4
T216	IC Engines & Gas Turbines	4	1	-	25	75	100	4
T199	Environmental Studies	4	-	-	25	75	100	4
T285	Probability & Statistics	4	1	-	25	75	100	4
P879	Thermal Engineering Lab	-	-	3	25	75	100	2
P866	Production Technology Lab	-	-	3	25	75	100	2
P857	Mini Project - II	-	-	2	25	25	50	2
	TOTAL	**24**	**04**	**08**	**225**	**625**	**850**	**30**

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V - SEMESTER

Code No.	Name of the Course	Scheme of Instruction			Scheme of Examination		Total	Credits
		Periods per Week			Maximum Marks			
		Lectures	Tutorial	Lab.	Internal	External		
T328	Thermal Engineering	4	1	-	25	75	100	4
T239	Machine Design –I	4	1	-	25	75	100	4
T170	Dynamics of Machines	4	1	-	25	75	100	4
T207	Fluid Power Engineering	4	1	-	25	75	100	3
T242	Machine Tools	4	-	-	25	75	100	4
T221	Industrial Management	4	-	-	25	75	100	3
P834	Fluid Mechanics &Hydraulic Machines Lab	-	-	3	25	75	100	2
P849	Machine Tools & Modeling Lab	-	-	3	25	75	100	2
P871	Seminar - II	-	-	1	50	-	50	1
	TOTAL	**24**	**04**	**07**	**250**	**600**	**850**	**27**

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VI - SEMESTER

Code No.	Name of the Course	Scheme of Instruction			Scheme of Examination		Total	credits
		Periods per Week			Maximum Marks			
		Lectures	Tutorial	Lab.	Internal	External		
T211	Heat Transfer	4	1	-	25	75	100	4
T240	Machine Design –II	4	1	-	25	75	100	4
T333	Unconventional Machining Processes	4	-	-	25	75	100	3
T290	Professional Ethics	3	-	-	25	75	100	3
T268	Operations Research	4	1	--	25	75	100	4
T276	Power Plant Engineering	4	-	-	25	75	100	4
T248 T228 T332 T331 T270	**ELECTIVE - I** Mechanical Vibrations Introduction to Aerospace Engineering Tribology Total Quality Management Optimization Techniques	4	--	--	25	75	100	3
P836	Heat Transfer Lab	-	-	3	25	75	100	2
P844	Mechanics of Machines Lab	-	-	3	25	75	100	2
P810	Comprehensive Viva-Voce - I	-	-	-	100	-	100	2
	TOTAL	**27**	**03**	**06**	**325**	**675**	**1000**	**31**

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VII - SEMESTER

Code No.	Name of the Course	Scheme of Instruction			Scheme of Examination		Total	credits
		Periods per Week			Maximum Marks			
		Lectures	Tutorial	Lab.	Internal	External		
T203	Finite Element Method	4	1	-	25	75	100	5
T132	CAD / CAM	4	-	-	25	75	100	4
T251	Metrology	4	-	-	25	75	100	4
T297	Refrigeration & Air Conditioning	4	1	-	25	75	100	4
T247	Mechanical Measurements	4	-	-	25	75	100	4
T324 T126 T249 T124 T148	**ELECTIVE – II** Theory of Elasticity Automobile Engineering Mechatronics Automation in Manufacturing Control Systems	4	-	-	25	75	100	3
P807	CAD / CAM Lab	-	-	3	25	75	100	2
P850	Metrology & Instrumentation Lab	-	-	3	25	75	100	2
P843	Internship	-	-	-	50	-	50	2
P878	Term Paper	-	-	1	25	25	50	2
	TOTAL	**24**	**02**	**07**	**275**	**625**	900	**32**

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VIII - SEMESTER

Code No.	Name of the Course	Scheme of Instruction			Scheme of Examination		Total	credits
		Periods per Week			Maximum Marks			
		Lectures	Tutorial	Lab.	Internal	External		
T300	Robotics	4	-	-	25	75	100	4
	ELECTIVE – III							
T107	Advanced Strength of Materials							
T263	Non Conventional Energy Sources							
T139	Cognitive Engineering	4	-	-	25	75	100	3
T208	Gas Dynamics							
T252	Micro Electro Mechanical Systems							
	ELECTIVE – IV							
T230	Introduction to Computational Fluid Dynamics							
T200	Experimental Stress Analysis	4	-	-	25	75	100	3
T288	Production Planning and Control							
T144	Computer Graphics							
T261	Nano Technology							
P867	Project Work	-	-	8	60	140	200	8
P811	Comprehensive Viva-Voce - II	-	-	-	100	-	100	2
	TOTAL	**12**	-	**8**	**235**	**365**	**600**	**20**
TOTAL CREDITS : 220								

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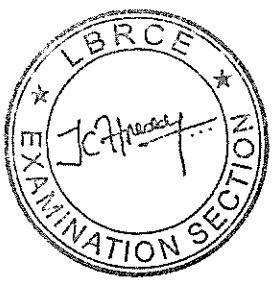
I-SEMESTER



T118 - APPLIED MATHEMATICS – I

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

Differential equations of first order and first degree – exact, linear and Bernoulli. Applications to Newton's Law of cooling, Law of natural growth and decay, orthogonal trajectories.

UNIT - II

Linear differential equations of second and higher order with constant coefficients and with variable coefficients, method of variation of parameters and their simple applications to Simple Harmonic Motion and Electrical Circuits.

UNIT - III

Generalized Mean Value theorems (without proof), Functions of several variables, Maxima and Minima of functions of two variables with constraints and without constraints. Lagrangian Multiplier method.

UNIT - IV

Curve tracing – Cartesian curves. Applications of Integration to Lengths, Volumes and Surface areas of revolution in Cartesian Coordinates. Multiple integrals - double and triple integrals (Cartesian Coordinates only) – Changing of order of Integration. (Cartesian Coordinates only)

UNIT - V

Vector Differentiation: Gradient- Divergence - Curl and their related properties of sums-products - Laplacian and second order operators. Vector Integration - Line integral – work done – Potential function – area - surface and volume integrals Vector integral theorems: Greens, Stokes and Gauss Divergence Theorems (Without proof) and related problems.

TEXT BOOKS

1. Higher Engineering Mathematics by Dr. B.S. Grewal
2. Higher Engineering Mathematics by Dr. B. V. Ramana – TMGH

REFERENCES

1. Advanced Engineering Mathematics by M. D. Greenberg – TMGH
2. Advanced Engineering Mathematics by Erwin Krezig - John Wiley & sons
3. Elementary Differential equations by W. E. Boyce and R. C. Diprima - John Wiley & sons
4. Advanced Engineering Mathematics by Peter V. O. Neil – Thomson

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T131 – C - PROGRAMMING

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

Algorithm / pseudo code, flowchart, program development steps, structure of C program, A Simple C program, identifiers, basic data types and sizes, Constants, variables, arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operators, expressions, type conversions, conditional expressions, precedence and order of evaluation.

Input-output statements, statements and blocks, if and switch statements, loops- while, do-while and for statements, break, continue, goto and labels, programming examples.

UNIT - II

Designing structured programs, Functions, basics, parameter passing, storage classes-extern, auto, register, static, scope rules, block structure, user defined functions, standard library functions, recursive functions, header files, C preprocessor, example c programs.

UNIT - III

Arrays- concepts, declaration, definition, accessing elements, storing elements, arrays and functions, two dimensional and multi-dimensional arrays, applications of arrays. pointers-concepts, initialization of pointer variables, pointers and function arguments, address arithmetic, Character pointers and functions, pointers to pointers, pointers and multidimensional arrays, dynamic memory managements 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, bitfields, C program examples.

UNIT - V

Input and output – 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. Computer science, A structured programming approach using C, B.A. Forouzan and R.F. Gilberg, Third edition, Thomson.
2. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education

REFERENCES

1. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
2. Programming in C – Stephen G. Kochan, III Edition, Pearson Eductaion
3. C and Data Structures:A Snap Shot Oriented Treatise Using Live Engineering Examples by Prof. N.B.Venkateswarlu and, Prof.E.V.Prasad, S Chand & Co, New Delhi
4. C/C++ for Engineers and Scientists, Harry H.Cheng ,McGrawHill,

T197 - ENGLISH - I

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

English Language continues to be regarded as an important tool for global communication and employability. Hence, it is imperative that students need to acquire communicative competence besides their core skills. The syllabus has been designed to develop linguistic and communicative competence of Engineering students with special emphasis on professional and functional aspects of English language i.e., on Listening, Speaking, Reading and Writing (LSRW Skills).

OBJECTIVES

- To improve the language proficiency of the students in English with emphasis on LSRW skills.
- To develop the study skills and Communication skills of the students in both formal and informal situations.
- To enable the students to face the academic and professional challenges of the present day scenario.
- To help students acquire the ability to speak effectively in English in the real life situations.
- To inculcate reading as a habit and to develop reading skills among students.
- To train students to improve their active and passive vocabulary.
- To familiarize the students with different rhetorical functions of Technical English.
- To enable the students write letters and reports effectively in formal and professional situations.

UNIT - I

Chapter – 1: "Read & Proceed" from Step by Step (*Pearson*)
Extensive Reading - Masterminds– The Trailblazers – **Jagadis Chandra Bose***(Orient Longman)*

UNIT - II

Chapter – 2: "Travel" from Step by Step (*Pearson*)
Extensive Reading - Masterminds– The World of Figures and Physics – **Chandra SekharaVenkata Raman** *(Orient Longman)*

UNIT - III

Chapter – 3: "Gender" from Step by Step (*Pearson*)
Extensive Reading - Masterminds–The Institution Builders– **Shanti SwarupBhatnagar** (*Orient Longman*)

UNIT - IV

Vocabulary – Synonyms, Antonyms, Words often Confused, Gerunds & Infinitives, Prefixes & Suffixes, Word plurals, Analogy
Grammar – Parts of Speech, Sentence Completion, Question Tags, Tense and Aspect

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UNIT - V

Analytical Writing – Sentence Construction – Types of sentences, Exercises with scrambled words & Jumbled sentences, Paragraph writing, Dialogue writing (Formal & Informal), Letter Writing (Formal & Informal), Resume writing, Expansion (of a given topic), Abstract Writing (Summarizing / Synopsis), Decision-making, Drafting E-Mails & Memo writing, Essay writing.

TEXT BOOKS

- Step by Step (*Pearson*)
- Masterminds by EnakshiChatterjee (*Orient Longman*)

REFERENCES

1. Andrea J Rutherford. *Basic Communication Skills for Technology*: Pearson Education, New Delhi, 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.

T264 - NUMERICAL METHODS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

Linear systems of equations: Rank-Echelon form, Normal form – Solution of Linear Systems – Direct Methods- Gauss Elimination - Gauss Jordon and Gauss Seidal Methods. Eigen values – Eigen Vectors – Properties – Cayley Hamilton Theorem – Inverse and Powers of a matrix by using Cayley Hamilton Theorem.

UNIT - II

Quadratic forms – Reduction to Canonical form – Rank and Nature of Quadratic form. Solution of Algebraic and Transcendental Equations: Introduction – The Method of False Position – Newton-Raphson Method.

UNIT - III

Interpolation: Introduction- Errors in Polynomial Interpolation – Finite differences- Forward 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 - IV

Numerical Differentiation and Integration – Differentiation using finite differences – Trapezoidal rule – Simpson's 1/3 Rule –Simpson's 3/8 Rule.

UNIT - V

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method-Runge- Kutta Methods –Predictor-Corrector Methods- Milne's Method. Curve fitting: Fitting a straight line –Second degree curve-exponential curve by method of least squares.

TEXT BOOKS

1. Higher Engineering Mathematics by Dr. B.S. Grewal
2. Higher Engineering Mathematics by Dr. B. V. Ramana – TMGH

REFERENCES

1. Introductory Methods of Numerical Analysis by S. S. Sastry – PHI
2. Numerical Methods for Engineers with programming and software application by Steven .C. Chopra and Ra. P. Canale – TMGH
3. Numerical Methods for scientific and engineering by M. K. Jain, S. R. K. Iyengar – New Age International ltd.

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T192 – ENGINEERING GRAPHICS

Lecture	**: 2 Period/week**	**Internal Marks**	**: 25**
Lab/Practicals	**: 5 Periods/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

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 used in engineering practice:

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:(First angle projection only)
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

SECTIONS OF SOLIDS:
Introduction-Sections of Prisms,Pyramids,Cylinders,Cones and Spheres

TEXT BOOK

Engineering Drawing, N.D. Bhat / Charitor publishers

REFERENCES

1. Engineering Drawing, Narayana and Kannaiah / Scitech publishers.
2. Engineering Drawing, R.K.Dhawan / S.Chand Company LTD.
3. Engineering Drawing and Graphics – Venugopal –New Age publishers
4. Engineering Drawing by Dhananjay A. Jolhe, Tata McGraw Hill Publishers.

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P806 – C - PROGRAMMING LAB

		Internal Marks	**: 25**
Lab/Practicals	**: 3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

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1. Write a programme in 'C' language to cover the following problems.
   a) Roots of Quadratic Equation.
   b) Example program which shows the usage of various Operators available in C Language.
   c) Example program which shows the usage of various preliminary Data types available in C Language.
   d) 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) Converting given two digit number into words using switch statement

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

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

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

f) Prepare electricity bill for the consumed units – assume suitable constraints.

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:
   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.

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V) 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.

VI) 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.
d) Write an example program to illustrate the usage of command line arguments.
e) 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 self referential 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)

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P812 – COMPUTER AIDED ENGINEERING GRAPHICS

		Internal Marks	**: 25**
Lab/Practicals	**: 3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

UNIT - I

COMPUTER AIDED DRAFTING

Introduction - Computer Aided drafting system – Advantages, Applications of AUTOCAD. Drafting software – AUTOCAD – Advantages, Initial setup commands, utility commands, Drawing Aids, Entity Draw commands, Display commands, Edit Commands.
Introduction Lettering – Basic types of Dimensioning, Linear, Angular and Radial Dimensioning.

UNIT - II

ORTHOGRAPHIC PROJECTIONS:

Introduction to orthographic Projections
Projections of Solids: Types of Solids, Prisms, pyramids , solids of revolution-simple positions Sections of Solids : Introduction – section & section planes – Types of section planes – True shape of a section.

UNIT - III

ISOMETRIC DRAWING :

Introduction - Theory of Isometric projection, Isometric view and Isometric drawing. Non – Isometric Lines – Methods to generate an Isometric Drawing.

UNIT - IV

DEVELOPMENT OF SURFACES OF SOLIDS:

Introduction – Theory of development - Methods of developments – Developments of lateral surfaces along with base.

UNIT - V

INTERSECTION OF SURFACES:

Introduction – Rules for visibility – Line of intersection – Intersection of Lines & Solids – Intersection of plane Vs plane - Intersection of surfaces of two solids, Interpenetration of two solids.

TEXT BOOKS

1. Engineering Graphics with AutoCAD by Bethune PHI Learning Private Limited, New Delhi, 2009.
2. Engineering Graphics with AutoCAD by M. Kulkarni, A.P Rastogi, and A.K. Sarkar; PHI Learning Private Limited, New Delhi, 2009.
3. Engineering Drawing, N.D. Bhat / Charitor

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P831 - ENGINEERING WORKSHOP

		Internal Marks	**: 25**
Lab/Practicals	**: 3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

TRADES FOR EXERCISES: (Common to EEE, ECE, CSE, EIE & IT)

At least three exercise from each trade :

1. Carpentry
2. Fitting
3. House – Wiring
4. Plumbing

TRADES FOR EXERCISES : (MECHCHANICAL ENGINEERING)

At least two exercise from each trade :

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

TEXT BOOK

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

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II-SEMESTER

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T119 - APPLIED MATHEMATICS – II

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

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

UNIT - IV

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions –solutions of first order linear (Lagrange) equation. Method of Separation of Variables - Applications to wave equation one dimensional, heat equation and Laplace Equation.

UNIT - V

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

TEXT BOOKS

1. Higher Engineering Mathematics by Dr. B.S. Grewal
2. Higher Engineering Mathematics by Dr. B. V. Ramana – TMGH

REFERNCES

1. Advanced Engineering Mathematics by Michael D. Greenberg – TMGH
2. Advanced Engineering Mathematics by Erwin Krezig - John Wiley & sons

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T198 - ENGLISH-II

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

English Language continues to be regarded as an important tool for global communication and employability. Hence, it is imperative that students need to acquire communicative competence besides their core skills. The syllabus has been designed to develop linguistic and communicative competence of Engineering students with special emphasis on professional and functional aspects of English language i.e., on Listening, Speaking, Reading and Writing (LSRW Skills).

OBJECTIVES

- To improve the language proficiency of the students in English with emphasis on LSRW skills.
- To develop the study skills and Communication skills of the students in both formal and informal situations.
- To enable the students to face the academic and professional challenges of the present day scenario.
- To help students acquire the ability to speak effectively in English in the real life situations.
- To inculcate reading as a habit and to develop reading skills among students.
- To train students to improve their active and passive vocabulary.
- To familiarize the students with different rhetorical functions of Technical English.
- To enable the students write letters and reports effectively in formal and professional situations.

UNIT - I

Chapter 4: "Disaster Management" from *Step by Step* (Pearson)
Extensive reading – *Masterminds* - The institution builders - **MeghanadSaha** *(*Orient Longman*)*

UNIT - II

Chapter 5: "Health" from *Step by Step* (Pearson)
Extensive reading – *Masterminds*- The New Age – **HomiJehangirBhabha** *(*Orient Longman*)*

UNIT - III

Chapter 6: "Sports" from *Step by Step* (Pearson)
Extensive reading – *Masterminds* - The New Age – **Vikram Sarabhai** *(*Orient Longman*)*

UNIT - IV

Grammar – Articles, Prepositions, Voice, Speech, Concord, Correction of Sentences
Vocabulary – Phrasal verbs, Gerunds, Infinitives, One word Substitutes.

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UNIT - V

Analytical writing – Comprehension, Technical dialogue writing,
Presentation skills - Note making, Information transfer / Data interpretation (Tables, Pie-charts, Bar graphs, Tree diagrams, Pictograms, etc.), Report writing

TEXTBOOK

Step by Step, Pearson Education, New Delhi 2010.
Master Minds, *(*Orient Longman*).*

REFERENCES

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

T191 - ENGINEERING CHEMISTRY

Lecture	**: 3 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

WATER TECHNOLOGY: Introduction, Hardness of Water - Temporary and Permanent hardness. Units and inter conversions of Units. Problems on Temporary and Permanent hardness. Boiler troubles – scale & sludge formation, Caustic embrittlement, Corrosion, priming & foaming, softening of water Methods of Treatment of Water for Domestic Purposes - Sedimentation, Coagulation, Filtration, Disinfection – Sterilization, Chlorination, Break point chlorination, Ozonization.
Water Treatment: Internal Treatment - Colloidal, Phosphate, Calgon, Carbonate, Sodium aluminates Conditioning of Water. External Treatment - Lime-Soda Process, Zeolite Process, Ion- Exchange Process.

UNIT - II

FUELS AND COMBUSTION: Definition and classification of Fuels- conventional fuels (solid, liquid, gaseous), Solid fuels- coal - analysis, Proximate and ultimate analyses of coal – significances, Liquid Fuels – primary- petroleum- refining of petroleum- cracking, knocking, synthetic petrol – Bergius and Fischer Tropsech's process; Gaseous fuels- octane number – cetane number,– water gas, producer gas CNG, and biogas - gross and net calorific values – (definition only) – flue gas analysis – Orsat's apparatus.

UNIT - III

CORROSION: Definition, Examples, Types of Corrosion: Theories of Corrosion and Mechanism - Dry Corrosion (Direct Chemical corrosion), Wet Corrosion (Electro Chemical corrosion) Principles of Corrosion, Galvanic Series, Galvanic Corrosion, Concentration Cell Corrosion, Mechanism of Wet and Chemical Corrosion - Hydrogen evolution type, Oxygen absorption type. Factors Influencing Corrosion. Control of Corrosion - Proper Design, Use of pure metal and metal alloys, Passivity, Cathodic Protection - Sacrificial anode and Impressed Current, Modifying the Environment and use of Inhibitors.

UNIT - IV

Polymer Science and Technology: Types of polymerization, Mechanism (Chain growth & step growth), Plastics –Thermosetting and Thermoplastic resins – preparation, properties and engineering applications of Polyethylene, PVC, Polystyrene, Teflon, Bakelite, Nylon, Conducting polymers: polyacetylene, polyaniline, conduction, doping, application. Characteristics and uses Rubber - Natural Rubber, Vulcanization and significance, Elastomers – Buna S, Buna N, Thiokol, Fibers- Polyester, fiber reinforced plastics (FRP), applications.

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UNIT - V

1. REFRACTORIES & INSULATORS: Definition, Classification with Examples, Criteria of a Good Refractory Material, Causes for the failure of a Refractory Material, Insulators – Definition and Classification with Examples. Characteristics of Insulating Materials, Thermal Insulators, Electrical Insulators - Their Characteristics and Engineering Applications.

2. LUBRICANTS: Introduction to Lubricants, Principles and function of lubricants - Types of Lubrication and Mechanism - Thick Film or Hydrodynamic Lubrication, Thin Film or Boundary Lubrication, Extreme Pressure Lubrication. Classification and properties of lubricants-Viscosity, flash and fire point, cloud and pour point, aniline point, Neutralization Number and mechanical strength, Selection of lubricants.

TEXT BOOKS

1. A text book of Engineering Chemistry by Jain & Jain, Dhanpat Rai Publishing Company, New Delhi (15th Edition) (2006).
2. A Text book of Engineering Chemistry by Dr. Y. Bharathi Kumari and Dr. Jyotsna Cherukuri, VGS Publications, First Edition, 2009.

REFERENCES

1. A Text book of Engineering Chemistry by Shashi Chawla, Dhanpat Rai Publishing Company, First Edition, 2002.
2. Advanced Engineering Chemistry by Dr. M. R. Senapati, University Science Press (Impart from Laxmi Publications), 3rd Edition 2009.
3. N. Krishnamurthy, P. Vallinayagam and D. Madhavan, Engineering Chemistry, 2nd Edition. PHI Learning PVT., LTD, New Delhi, 2008.
4. A Text book of Engineering Chemistry by S. S. Dara, S CHAND Publications.

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T193 – ENGINEERING MECHANICS – I

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 5**	**External Examination**	**: 3 Hrs**

UNIT - I

Introduction to Engg. Mechanics – Basic Concepts.
Resultant of Systems of Forces: Resultant of Coplanar Concurrent Forces – Resultant of Coplanar Non-Concurrent Forces.
Moments: Introduction to Moment, Moment of Force and its Applications, Principle of moments – Couples and Resultant of Force Systems.

UNIT - II

Equilibrium of Systems of Forces: Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Lami's Theorem, conditions of equilibrium.

UNIT - III

FRICTION: Introduction, Classification of friction, Laws of friction. Co-efficient of friction, Angle of friction, Angle of repose, Frictional forces on motion of bodies, Wedge friction.

UNIT - IV

Centroid: Centroids of simple figures (from basic principles) – Centroids of Composite Figures
Centre of Gravity: Centre of gravity of simple bodies (from basic principles), centre of gravity of composite Bodies.

UNIT - V

AREA MOMENT OF INERTIA
Moment of Inertia of a plane figure with respect to an axis in its plane–Moment of inertia with respect to an axis perpendicular to the plane of the figure – Parallel axis theorem, Moment of Inertia of composite figures.

TEXT BOOKS

1. Engineering Mechanics / Fedinand . L. Singer / Harper – Collins
2. Engineering. Mechanics / Timoshenko, Young and Rao – TATA Mc Graw Hill.

REFERENCES

1. Engineering. Mechanics / S.S. Bhavikatti – NEW AGE
2. Engineering Mechanics / AK Tayal. ,Umesh Publications
3. Vector Mechanics for Engineers Statics and Dynamics by Beer and Johnston, TATA Mc Graw Hill.

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T195 - ENGINEERING PHYSICS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

INTERFERENCE: Superposition of waves-double slit interference- Young's double slit experiment- Coherence – Interference from thin films- Newton's rings.
DIFFRACTION: Diffraction and wave theory of light (Fresnel and Fraunhofer diffractions) - single slit Diffraction, Intensity in single- slit diffraction, Calculating the intensity– Double slit interference and diffraction combined.
GRATINGS AND SPECTRA - Multiple slits-width of the maxima, Diffraction gratings, Grating spectrum – Dispersion and Resolving power.
POLARIZATION: Polarization by reflection Brewster's law - Double refraction -Polarization by scattering - Retarders -Optical Activity.

UNIT - II

CRYSTAL STRUCTURES: Introduction –periodic arrays of atoms-Lattice translation vectors, Basis and crystal structure, Primitive cell, fundamental types of lattices-three dimension lattice types, Crystal systems- Structure and packing fractions of Simple cubic-Body centered cubic- Face centered cubic crystals.
X-RAY DIFFRACTION: Directions and planes in crystals – Miller indices – separation between successive (h k l) planes- Diffraction of X- rays by crystal planes – Braggs law-Laue method- powder method.

UNIT - III

LASERS: Introduction – Characteristics of Lasers- Principle of laser (Absorption, Spontaneous and stimulated emission of Radiation), Einstein Coefficients- Population Inversion - Helium Neon Laser, Semiconductor laser, Applications of Lasers.
FIBER OPTICS: Introduction- Principle of optical Fiber- Acceptance angle and Acceptance cone- Numerical aperture - refractive index profile-Application of optical fibers.

UNIT - IV

SUPER CONDUCTIVITY : Phenomenon, Meissner effect, critical parameters, Type I, Type II Super conductors, BCS theory of super conductivity, Applications of Super conductors.

UNIT - V

NON-DESTRUCTIVE TESTING USING ULTRASONICS: Characteristics Production and detection of ultrasonics-Piezoelectric and magnetostirictionmethods,Ultrasonic Testing - Basic Principle –Transducer – Couplant and inspection Standards – Inspection Methods – Pulse echo Testing Technique – Flaw detector- Different Types of Scans – Applications.

TEXT BOOKS

1. Fundamentals of physics Resinic, Halliday and Krane, John Wiley 2003
2. Engineering Physics by V RAJENDRAN TataMcGrahill

REFERENCES

1. Introduction to solid state physics, C. Kittel, John wiley, 1999.
2. Engineering physics by H K MALIK AK SINGH TATA McGRAHILL

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P832 - ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

		Internal Marks	**: 25**
Lab/ Practicals : 3 Period/Week		**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

The English Language Communications Skills Lab focuses on practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts. It aims at improving the communicative competence of students and to enrich their power of expression, articulation and persuasiveness. The thrust is on developing competences, both linguistic as well as communicative, in order to improve employability potential.

OBJECTIVES

1. To expose the students to a variety of self-instructional, learner-friendly modes of English language learning and stimulate intellectual and attitudinal exercise.
2. To provide students with the required facility and practice to face computer-based competitive exams such GRE, TOEFL, IELTS etc.
3. To enable them to learn better pronunciation through emphasis on word accent, intonation, and rhythm.
4. To train them to use language effectively to face interviews, group discussions, public speaking.
5. To develop necessary attitudes and behaviors so as to improve their employability quotient.

SYLLABUS

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

1. Dimensions of Phonetics: Phonetic Transcription, Sounds, Stress, Intonation, Rhythm, Varieties of Spoken English: Indian, British and American
2. Oral Presentations -- Prepared and Extempore -- JAM
3. Role Play
4. Describing Objects / Situations / People
5. Information Transfer
6. Debates
7. Group Discussions

SUGGESTED SOFTWARE/BOOKS

* *Digital Mentor*, Globarena, Hyderabad, 2005
* *Sky Pronunciation Suite: Young India Films, Chennai, 2009*
* Mastering English in Vocabulary, Grammar, Spelling, Composition, Dorling Kindersley, USA, 2001
* Dorling Kindersley Series of Grammar, Punctuation, Composition, Dorling Kindersley, USA, 2001
* *Oxford Talking Dictionary,* The Learning Company, USA, 2002
* *Cambridge Advanced Learners English Dictionary* (with CD). Cambridge University Press, New Delhi, 2008.
* Learning to Speak English - 4 CDs. The Learning Company,USA,2002
* Herbert Puchta and Jeff Stranks with Meredith Levy: *English in Mind*: Cambridge University Press, New Delhi, 2009.

Krishna Mohan, Effective English Communication, Tata McGraw Hills, New Delhi,2007

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P830 - ENGINEERING PHYSICS AND CHEMISTRY LAB

		Internal Marks	**: 25**
Lab/Practicals	**: 3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

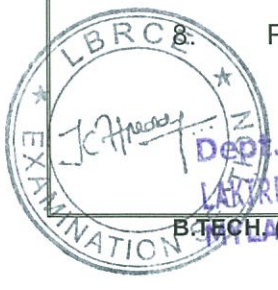
ENGINEERING PHYSICS LABORATORY
(Any 5 experiments)

LIST OF EXPERIMENTS

1. LCR Resonance circuit
2. Newton's Rings – Determination of Radius of curvature of plano convex lens
3. Verification of laws by using sonometer
4. Meldy's experiment
5. Wedge shaped film
6. Volume Resonator
7. Refractive index of light
8. Diffraction Grating – Normal incidence method
9. Rigidity modulus of a given wire
10. Frequency of AC supply – Sonometer

ENGINEERING CHEMISTRY LABORATORY
(Any 5 experiments)

1. Estimation of total Hardness of water by EDTA method
2. Determination of Temporary and permanent hardness of water.
3. Iodometric Titration of $K_2Cr_2O_7$ v/s $Na_2S_2O_3$ to determine the percentage purity of $K_2Cr_2O_7$ sample.
4. Preparation of Stanard Potassium Dichromate and Estimation of Copper by Iodometry.
5. Determine the amount of Oxalic acid and Sulphuric acid in 1 liter solution by using given standard Sodium Hydroxide and Potassium Permanganate solution
6. Determination of alkalinity of water sample.
7. Determination of Dissolved Oxygen (DO) content by Winkler's method.
8. Preparation of Urea formaldehyde resin.



P845 – LAB.VIEW

		Internal Marks	**: 25**
Lab/Practicals	**: 3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

LAB - I

Exercise 1. Open and Run a VI
Objective: Open, run, and explore the components of a VI.
Open the Temperature System Demo VI from the tutorial_1 directory.

Exercise 2. Use of LabVIEW help utilities
Objective: Become familiar with the context help and the LabVIEW help
Open the Temperature System Demo VI from the tutorial_1 directory if it is not already open from Exercise 1.

Exercise 3. Create a VI
Objective: Build a simple VI that converts a Celsius temperature reading to Fahrenheit.

Exercise 4. Document a VI
Objective: Document a VI that you have created.

Exercise 5. Navigation and editing
Objective: To learn LabVIEW editing techniques.

Exercise 6. Debug a VI
Objective: To use the probe tool and the probe window and to examine data flow in the block diagram using execution highlighting.

LAB - II

Converting a VI into a sub VI (Exercise)
Use of sub-VI (demo)
Debug a VI (Demo)
Debug Main (Exercise)
Mechanical action of Boolean (Demo)
While Loop & Charts (exercise)
While Counter (Exercise)
Moving averages (Exercise)
Shift Register (Exercise)
Die Roller (Exercise)

LAB - III

Case structure (Demo)
Calculator
SEQUENCE STRUCTURE
Building arrays with loops (Demo)
Building arrays with loops (Exercise)
Build array function (demo)
Building Tables (demo)
Replace array elements
Sort array values
Temperature Analysis

LAB - IV

Case structure (Demo)
Calculator
SEQUENCE STRUCTURE
CLUSTER ERROR. FIND AND RECTIFY?
BUTTON SELECTION (Demo)
BUTTON SELECTION with Shift Register (Demo)
LOCALS FOR PARALLEL LOOP CONTROL
LOCAL FOR RESET
LOCALS FOR CONTROL
Global Variables (Demo)
Function Generator (demo)
Noisy Signal (Demo)
Noisy Signal Analyzer (Demo)
Noisy Signal Analyzer with Filter (Demo)

LAB - V

Modeling and simulation of Physical Systems

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III-SEMESTER

T194 - ENGINEERING MECHANICS-II

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

MASS MOMENT OF INERTIA: Moment of inertia of a rigid body – Moment of inertia of lamina- slender bar, rectangular plate, Circular plate, circular ring, Moment of inertia of 3D bodies- cone, solid cylinder, solid sphere. Moment of Inertia of composite bodies.

UNIT - II

KINEMATICS: Introduction, displacement, velocity and acceleration. Motion with Uniform and Variable acceleration. Angular displacement, Angular velocity and Angular acceleration. Equations of Motion along a circular path.

UNIT - III

PROJECTILES: Introduction, Basic Definitions, Projectile equations, Horizontal projection, Inclined Projection, Projectile on Horizontal plane and Inclined plane.

UNIT - IV

KINETICS: Equations of rectilinear motion. Equations of Dynamic Equilibrium, D'Alembert's Principle, Motion of connected bodies, Bodies in curvilinear translation, Kinetics of bodies rotating about fixed axis, Kinetics of rolling bodies.

UNIT - V

Work – Energy Method: Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion.

TEXT BOOK

Engineering Mechanics / Fedinand . L. Singer / Harper – Collins

REFERENCES

1. Engg. Mechanics / S.S. Bhavikatti – NEW AGE
2 Engg. Mechanics / Timoshenko, Young and Rao – TATA Mc Graw Hill.
3. Engg. Mechanics / AK Tayal.
4. Vector Mechanics for Engineers Static's and Dynamics by Beer and Johnston, TATA Mc Graw Hill.

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T330 - THERMODYNAMICS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

Basic Concepts and Definitions: Introduction, Macroscopic and Microscopic View Point, Continuum, System, Control Volume, Properties of System, State and Equilibrium-Thermodynamic Equilibrium, Processes –Quasi static process, Cycle, 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 Change of System, First Law Analysis of Closed System- Moving Boundary Work –Polytrophic Process, Energy Balance, Internal Energy, Specific Heat

First Law Analysis of Control Volume-Conservation of Mass, Conservation of Energy Principle-Flow work, Total Energy of Flowing Fluid, 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 Principles, Thermodynamic Temperature Scale.

Entropy: Introduction, Clasius Inequality, Property Diagrams, Tds-Relations, Maxwell Relation, Entropy Change for Ideal gases, Isentropic relations for ideal gases, Principle of Increase of Entropy-Closed and Control Volumes, 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.

Pure Substance: Introduction, Phases of Pure Substance, Phase Change Processes, Property Diagrams (T-v, P-v, P-T), P-v-T Surface, Property Tables.

UNIT - V

Gas Power Cycles: Introduction, Analysis of Power Cycles- Carnot, Otto, Diesel, Dual, Stirling, Atkinson, Ericsson, Lenoir and Brayton.

Vapor Power Cycles: Analysis of Carnot Vapor Cycle, Simple Rankine Cycle.

Refrigeration Cycles: Reveresd Carnot Cycle, Bell-Coleman Cycle, Simple Vapor Compression Cycle.

TEXT BOOK

Fundamentals of Engineering Thermodynamics- Second Edition, E. Rathakrishnan-PHI

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REFERENCES

1. Thermodynamics: An Engineering Approach—Cengel, Y.A and Boles, M.A. McGraw-Hill
2. Fundamentals of Classical Thermodynamics – G.J.Van Wylen & Sonntag.TMH
3. Engineering Thermodynamics – P.K.Nag, TMH

T319 – STRENGTH OF MATERIALS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

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 the equation M/I = E/R = f/y – section modulus - calculation of normal stresses due to flexure application.
TORSION: Theory of torsion and assumptions - derivation of the equation T/J = Cθ/L = q/r, 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 - area moment method for stepped beams with concentrated loads.
THIN, THICK AND SPHERICAL SHELLS: Hoop and longitudinal stress- thin and thick cylinders- spherical shells-changes in dimensions and volume.

TEXT BOOK

S.Ramamrutham, Strength of Materials, Dhanpat Rai & Sons

REFERENCES

1. Popov, E.P., Mechanics of Materials, Prentice Hall Inc., 1976.
2. Andrew, P. and Singer, F.L., icsStrength of Materials, Harper and Row Publishers, New York, 1987.
3. M.L.Gambhir, Fundamentals of Solid Mechanics, PHI Learning.
4. R.Subramanian, Strength of Materials, Oxford University Press

T250 – METALLURGY AND MATERIAL SCIENCE

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

Structure of Metals: Bonds in Solids – Ionic bond, covalent bond and metallic bond - 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 Substitutional 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 Fe-Fe_3C equilibrium diagrams.

UNIT - III

Steels: Classification of steels, structure and properties of plain carbon steels-low carbon steel, medium carbon steel and high carbon steel.
Cast Irons: Structure and properties of white cast iron, malleable cast iron, grey cast iron, spheroidal graphite cast iron.
Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys.

UNIT - IV

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. Hardenability-determination of hardenability by jominy end quench test. Surface - hardening methods and age hardening treatment.

UNIT - V

Ceramic Materials: Properties and applications of ceramic materials, glasses, cermets, and abrasive materials
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.

TEXT BOOK

Introduction to Physical Metallurgy / Sidney H. Avener-Tata McGraw-Hill

REFERENCES

1. Engineering Materials and Their Applications/Richard A.Flinn, Paul K.Trojan-Jaico Publishing House.
2. Material Science and Metallurgy/kodgire- Everest Publishing House.
3. Science of Engineering Materials / Agarwal
4. Materials Science and engineering / William and collister.

T177 – ELECTRICAL AND ELECTRONICS ENGINEERING

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

Electrical Circuits: Basic definitions, Types of elements, Ohm's Law, Resistive networks, Kirchhoff's Laws, Inductive networks, capacitive networks, Series, Parallel circuits and Star-delta and delta-star transformations

UNIT - II

AC Machines: Principle of operation of alternators – regulation by synchronous impedance method – MMF and zero power factor methods. Principle of operation of induction Principle of operation of three-phase induction motors –Slip ring and Squirrel cage motors – Slip-Torque characteristics

UNIT – III

Transformers: Principle of operation of single phase transformers, Ideal transformer, Practical transformer, phasor diagram.– emf equation – losses –efficiency and regulation..

UNIT - I V

Diode and Transistors: P-n junction diode, symbol, V-I Chacracteristics, DiodeApplications, Rectifiers – Half wave, Full wave and Bridge rectifiers (simple Problems).PNP and NPN Junction transistor, Transistor as an amplifier, SCR characteristics and applications.

UNIT - V

Electrical and Electronics Measuring Instruments.
Electrical Instruments: Basic Principle of indicating instruments – permanent magnet moving coil and moving iron instruments.
Electronic Instruments: Principles of CRT (Cathode Ray Tube), Deflection, Sensitivity, Electrostatic and Magnetic deflection, Applications of CRO - Voltage, Current and frequency measurements.

TEXT BOOK

Essentials of Electrical and Computer Engineering by David V. Kems, JR. J. David Irwin/Pearson.

REFERENCES

1. Introduction to Electrical Engineering – M.S Naidu and S. Kamakshaiah, TMH Publ.
2. Basic Electrical Engineering by Kothari and Nagarath, TMH Publications, 2nd Edition.
3. Electrical Technology by JB GUPTA

LBRCE EXAMINATION SECTION

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T241 - MACHINE DRAWING

Lecture	**: 6 Periods/week**	**Internal Marks**	**: 25**
		External Marks	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

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, 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.

I. DRAWING OF MACHINE ELEMENTS AND SIMPLE PARTS

Selection of Views, additional views for the following machine elements and parts with every drawing proportions.

a) Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws.
b) Keys, cottered joints and knuckle joint.
c) Rivetted joints for plates
d) Shaft coupling, spigot and socket pipe joint.
e) Journal, pivot and collar and foot step bearings.

II. ASSEMBLY DRAWINGS

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

a) Engine parts – stuffing boxes, cross heads, Eccentrics, Petrol Engine connecting rod, piston assembly.
b) Other machine parts - Screws jacks, Machine Vices Plummer block, Tailstock.
c) Valves: Steam stop valve, spring loaded safety valve, feed check valve and air cock.

NOTE : First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

TEXT BOOK

1. Machine Drawing –K.L.Narayana, P.Kannaiah & K. Venkata Reddy / New Age/ Publishers.

REFERENCES

1. Machine Drawing – P.S.Gill.
2. Machine Drawing – Luzzader.
3. Machine Drawing – Rajput.
4. Machine Drawing – Dhawan, S.Chand Publications.

LBRCE EXAMINATION SECTION

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P877 – STRENGTH OF MATERIALS AND METALLURGY LAB

		Internal Marks	**: 25**
Lab/Practicals:	**3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

Any of the 10 Experiments are required to be conducted

STRENGTH OF MATERIALS

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.
6. Hardness test on metals.
7. Deflection test on beams.

METALLURGY LAB

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.
8. Wear Test.
9. Tension test on electronic tensometer.
10. Preparation of specimen by using liquid metallurgy.

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P821 – ELECTRICAL AND ELECTRONICS LAB

		Internal Marks	**: 25**
Lab/Practicals	**: 3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

Any of the 10 Experiments are required to be conducted

LIST OF EXPERIMENTS

1. Brake Test on 3-Ph Squirrel Cage Induction Motor
2. Regulation of 3-Ph Alternator by Synchronous Impedance Method
3. O.C &S.C tests on 1-phase transformer
4. Separation of core losses of 1-phase transformer
5. Load Test on 1-phase Transformer
6. Mesh Analysis
7. Nodal Analysis
8. RL & RC Series circuits
9. Diode characteristics
10. Transistor characteristics

ADDITIONAL EXPERIMENTS

11. CE Amplifier
12. Half wave & Full wave rectifiers

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IV-SEMESTER

T289 - PRODUCTION TECHNOLOGY

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

Casting: Steps involved in making a casting – Advantage of casting and its applications. – Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Principles of Gating, Gating ratio and design of Gating systems. Risers – Types, Function and Design, casting design considerations, special casting processes 1) Centrifugal 2) Die, 3) Investment.
Melting Practice- Furnaces: Cupola, Crucible and Induction furnace

UNIT - II

Welding: Classification of welding process, types of welds, welded joints and their characteristics. Principle and applications-Gas welding-Arc welding-Forge welding-Resistance welding-Thermit welding-Oxy – Acetylene Gas cutting- Welding defects – Causes and remedies.

UNIT - III

Inert Gas welding, TIG & MIG welding, Friction welding, Induction welding, Explosive welding, Laser welding, Soldering & Brazing.

UNIT - IV

Metal Forming Processes: Rolling fundamentals – theory of rolling, types of Rolling mills and Products- Principles of forging – Tools and dies – Types of Forging – Smith forging, Drop Forging- Drawing and its types – wire drawing and Tube drawing – coining – Hot and cold spinning

UNIT - V

Extrusion of Metals: Basic extrusion process and its characteristics. Hot extrusion and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion, Hydrostatic extrusion.
Sheet Metal Operations: Stamping, forming and other cold working processes: Blanking and piercing – Bending and forming

TEXT BOOK

Manufacturing Engineering and Technology/Kalpakjain S/ Pearson Edu.

REFERENCES

1. Manufacturing Technology / P.N. Rao/TMH
2. Production Technology / R.K. Jain
3. Process and materials of manufacturing –Lindberg/PE
4. Production Technology /Sarma P C /
5. Workshop Technology-B.S. Raghuvamsi-Vol.I /PHI

T234 - KINEMATICS OF MACHINES

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

MECHANISMS: Elements – Classification –Types of kinematic pairs –Types of motions – Degree of freedom-Gruebler's criterion- 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- T. 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 MECHANISMS: 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- Tangent cams.

UNIT - IV

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 –Epicyclic gear trains – Differential gear for an automobile.

UNIT - V

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

TEXT BOOK

Theory of Machines and Mechanisms- S.S.Rattan, Tata McGraw Hill Publishers

REFERENCES

1. Theory of Machines and Mechanisms – Shigley.J.E, McGraw-Hill.
2. Theory of Machines by Thomas Bevan/ CBS.
3. Mechanism and Machine Theory -JS Rao and RV Dukkipati , New Age.
4. Theory of Machines - Sadhu Singh - Pearson Education.

T204 - FLUID MECHANICS

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1 Period/Week	External Marks	: 75
Credits	: 4	External Examination	: 3 Hrs

UNIT - I

Introduction: General description of Fluid Mechanics, Classification of Fluids, Fluids and Continuum, Properties of Fluid – Pressure, Temperature, Density, Specific Weight, Specific Gravity, Viscosity, Compressibility, Surface Tension, Capillarity, Vapor Pressure, Cavitation.
Fluid Statics: Pressure Force on a Fluid Element, Hydrostatic Pressure Distributions, Hydrostatic forces on submerged plane and curved surfaces, Manometers, Buoyancy and Stability

UNIT - II

Analysis of Fluid Flow: Eulerian and Lagrangian approaches, Velocity Field, Flow Patterns- Pathline, Streamline, Streakline, Timeline, Stream Tube
Differential Relations for Fluid Flow: Acceleration Field of a Fluid, Differential Equation of Mass Conservation, Differential Equation of Linear Momentum, Euler's Equation, Navier-Stokes Equations, Stream Function, Vorticity and Irrotationality, Velocity Potential, Rotationality, Potential Flow, Bernoulli Equation and Applications-Venturi meter, Orifice meter, Limitations on the use of the Bernoulli equation, Free and Forced Vortex Flows

UNIT - III

Flow Through Pipes: Introduction, Reynolds number and its importance, Reynolds Experiment, Hydraulic Gradient and Total Energy Lines, Head loss, Darcy-Wiesbach equation, Laminar Fully Developed Pipe Flow- Hagen Poiseuille Law, Moody Chart , Pipes in Series, Equivalent Pipe, Pipes in Parallel, Minor Losses, Water hammer in Pipes,
Flow in Noncircular Ducts: Hydraulic Diameter, Fully developed laminar flow between parallel plates, Fully developed laminar flow through a concentric annulus,

UNIT - IV

Boundary Layer: Introduction, Boundary layer development, Boundary layer thickness, Displacement thickness, Momentum thickness, Energy thickness, Types of boundary layer, Momentum Integral Estimates- Karman Analysis of the Flat plate, Boundary layer Equaltions-2D Flow, Boundary layer growth on a flat plate-Blasius Solution, Boundary Layer with Pressure Gradient, Brief discussion on Lift and Drag

UNIT - V

Dimensional Analysis and Similarity: Introduction, Principle of Dimensional Homogeneity, Buckingham's Pi Theorem, Dimensionless Groups, Similarity.
Introduction to Compressible Flow: Introduction, Perfect gas, Speed of sound, Mach Number, Specific heat ratio, Flow regimes based on Mach number, Compressibility-limiting condition for compressibility.

TEXT BOOK

Fluid Mechanics, White F.M. Tata McGraw-Hill

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REFERENCES

1. Fluid Mechanics-E. Rathakrishnan- PHI, 2007
2. Mechanics of Fluids, Shames, H.,
3. Introduction of Fluid Mechanics, Fox, R.W., and Mcdonald, A.J
4. Fluid Mechanics, Kundu, P.K., and Cohen, I.M.,, 2nd ed., Academic Press, 2002
5. Fluid Mechanics, Douglas, J.F., Gesiorek, J.M., and Swaffield, J, A., 4th ed., Pearson Education, 2002

T216 - IC ENGINES AND GAS TURBINES

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

Introduction: Heat Engine, Classification of Heat 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
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, Cooling and Lubricating systems

UNIT - II

Air-Standard Cycles and Their Analysis: Introduction, Carnot, Otto, Diesel, Dual, 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 and Chart

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.
Jet Propulsion Systems: Introduction-Qualitative treatment of TurboJet, TurboFan, Turboprop, Ramjet

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TEXT BOOK

I.C. Engines - V.Ganesan - T.M.H., New Delhi.

REFERENCES

1. Fundamentals of I.C.Engines - P.W. Gill, J.H. Smith & Ziurys- IBH & Oxford pub.
2. A Course in I.C. Engines - M.L. Mathur & R.P. Sharma - Dhanpat Rai & Sons – New Delhi.
3. Gas Turbine Theory - Cohen, Rogers and Sarvanamuttu. ,Longman Group limited,England
4. Treatise on heat Engineering - Vasandani & Kumar-Metropolitan Book Company, Delhi.
5. Engineering Fundamentals of the I.C.Engines- Pulkrabek-PHI

T199 – ENVIRONMENTAL STUDIES

Lecture	**: 3 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

Multidisciplinary nature of Environmental Studies: Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems -Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. **[11 Lectures]**

UNIT – II

Ecosystems : Concept of an ecosystem. - Structure and function of an ecosystem.- Producers, consumers and decomposers. - Energy flow in the ecosystem – Ecological succession. - Food chains, food webs and ecological pyramids.

Biodiversity and its conservation: Introduction - Definition: genetic, species And ecosystem diversity. - Bio-geographical classification of India - Value of Biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. - India as a mega diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. - Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

[11 Lectures]

UNIT – III

Environmental Pollution: Definition, Types, Cause, effects and control measures of:

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes. - Role of an individual in prevention of pollution. - Pollution case studies. - Disaster management: floods, earthquake, cyclone and landslides. **[11 Lectures]**

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UNIT – IV

Social Issues and the Environment: From Unsustainable to Sustainable development -Urban problems related to energy -Water conservation, rain water harvesting, watershed management -Resettlement and rehabilitation of people; its problems and concerns. Case Studies -Environmental ethics: Issues and possible solutions. -Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. -Wasteland reclamation. – Consumerism and waste products. **[11 Lectures]**

UNIT – V

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programme -Environment and human health. -Human Rights. -Value Education. HIV/AIDS. -Women and Child Welfare. -Role of information Technology in Environment and human health. –Case Studies. Environment Protection Act. -Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act -Issues involved in enforcement of environmental legislation. -Public awareness. **[11 Lectures]**

TEXT BOOKS

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCES

Textbook of Environmental Sciences and Technology by M. Anji Reddy BS Publication.

T285 – PROBABILITY AND STATISTICS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

Probability: Sample space and events – Probability – The axioms of probability – Some Elementary theorems - Conditional probability – Baye's theorem.

UNIT - II

Random variables – Discrete and continuous distributions - Distribution function. Binomial, Poisson, normal distribution – related properties. Moment generating function, Moments of standard distributions, Evaluation of mean, standard, variance, kurtosis and skewness.

UNIT - III

Population and samples. Sampling distribution of mean (with known and unknown variance), proportion, variances. - Sampling distribution of sums and differences. Point and interval estimators for mean, variance and proportions.

UNIT - IV

Statistical Hypothesis – Errors of Type I and Type II errors and calculation. One tail and two-tailed tests. 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

Simple Correlation and Regression.
Queuing Theory: Pure Birth and Death Process M/M/1 Model and Simple Problems related to the evaluation of waiting time, length of the queue etc. ,

TEXT BOOK

Probability and Statistics for Engineers, Miller ,John E. Freund, PHI

REFERENCES

1. Probability and Statistics, Gupta & Kapoor
2. Probability, Statistics and Queuing theory applications for Comp. Sciences, 2/e, Trivedy, John Wiley

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P879 - THERMAL ENGINEERING LAB

		Internal Marks	**: 25**
Lab/Practicals	**: 3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

Any of the 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.

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P866 - PRODUCTION TECHNOLOGY LAB

		Internal Marks	**: 25**
Lab/Practicals	**: 3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

Any of the 10 Experiments are required to be conducted

I. METAL CASTING LAB

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

II WELDING LAB

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

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V-SEMESTER

T328 - THERMAL ENGINEERING

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

Vapour Power Cycles: Introduction, Carnot Vapour Cycle, Rankine Cycle, Actual Vapour Power Cycle, Methods to improve efficiency of Rankine cycle, Reheating, Regeneration-Open and Closed Feed Water Heater
Combustion: Fuels and combustion, concepts of heat of reaction, Adiabatic flame temperature, Stoichiometry

UNIT - II

Boilers: Introduction, Function and Types of Boilers, Fire Tube–Cornish, Lancashire, Cochran, Water Tube-Babcock and Wilcox, Mountings and Accessories–Working principles
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 supercooling -Wilson line

UNIT - IV

Steam Turbines: Introduction, Classification, Impulse turbine- 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.
Steam Condensers: Introduction, Types, Working principle, vacuum efficiency and condenser efficiency

UNIT - V

Compressors– Introduction, Classification
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 – efficiency considerations
Centrifugal: Principle of operation –Energy transfer-velocity diagram
Axial: Principle of operation – velocity triangles and energy transfer per stage, degree of reaction,

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TEXT BOOK

Thermodynamics and Heat Engines , VOL-II, R. Yadav , Central Book Depot

REFERENCES

1. Applied Thermodynamics, T.D Eastop and A. McConkey, Pearson Education
2. Basic Engineering Thermodynamics, Rayner Joel, Fifth Edition, AWL
3. Thermal Engineering, Mahesh Rathore, TMH
4. Basic Engineering Thermodynamics, Roy Choudhury
5. Power Plant Engineering, P.K Nag, TMH

T239 - MACHINE DESIGN – I

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

Machine Design Data Books are Permitted

UNIT - I

INTRODUCTION: Basic procedure of machine design– Basic requirements of machine design – 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 moment-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-S-N curve-Notch sensitivity-Endurance limit-Approximate estimation-Reversed stresses-Design for finite and infinite life problems-Soderberg and Goodman lines-Gerber equation- Impact stresses

UNIT - III

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

WELDED JOINTS: Butt joints-Fillet joints-Strength of butt joints-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

POWER SCREWS: Forms of thread-Multiple threaded screws-Terminology-Torque requirement for lifting and lowering loads-Self locking screw-Efficiency of square threaded screw-Efficiency of self locking screw- design of screw and nut-Design of screw jack.

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

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TEXT BOOK

Mechanical Engineering Design/Shigley. J.E/ Mc Graw-Hill

REFERENCES

1. Design of Machine Elements/ V.B. Bandari /Mc Graw-Hill
2. Machine Design / R.N. Norton /Pearson education.
3. Machine design / Allen S. Hall/Schaum Series.
4. Machine Design / Dr Rajendra Karwa/ Lakshmi Publications.
5. Machine design / Pandya & shah/Charotar Publishing house.
6. Data Books : (i) P.S.G. College of Technology (ii) Mahadevan

T170 - DYNAMICS OF MACHINES

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

FRICTION : Inclined plane-friction of screw and nuts-pivot and collar-uniform pressure-uniform wear- friction circle and friction axis - lubricated surfaces- boundary friction- film lubrication.
Clutches: Friction clutches- Single Disc or plate clutch- Multiple Disc Clutch- Cone Clutch-Centrifugal Clutch.

UNIT - II

BRAKES AND DYNAMOMETERS : Simple block brakes- internal expanding brake- band brake of vehicle- Dynamometers – Absorption and transmission types-General description and methods of operations.
PRECESSION : Gyroscopes- effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships- Static and dynamic force analysis of planar mechanisms.

UNIT - III

TURNING MOMENT DIAGRAM AND FLY WHEELS: Turning moment – Inertia Torque connecting rod angular velocity and acceleration, crank effort and torque diagrams – Fluctuation of energy – Fly wheels and their design.

UNIT - IV

GOVERNORS: Watt, Porter and Proell governors- Spring loaded governors – Hartnell governor- Sensitiveness- isochronism - hunting.
VIBRATIONS: Types of vibrations-Basic features of vibrating systems-Degrees of freedom-Free longitudinal vibrations-Equilibrium method-Energy method- Rayleigh's method.

UNIT - V

BALANCING : Balancing of rotating masses -Single and multiple – single and different planes-Balancing of reciprocating masses - Primary, Secondary and higher balancing of reciprocating masses -Analytical and graphical methods - Unbalanced forces and couples - locomotive balancing – Hammer blow-Swaying couple - variation of tractive efforts.

TEXT BOOK

Theory of Machines / S.S Ratan/ Mc. Graw Hill

REFERENCES

1. Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age
2. Theory of Machines / Shiegly / MGH
3. Theory of Machines / Thomas Bevan / CBS Publishers
4. Theory of Machines / Jagadish Lal & J.M.Shah / Metropolitan.

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T207 - FLUID POWER ENGINEERING

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

Impact of Water Jets: Hydrodynamic force of Jets on Stationary and Moving Flat, Inclined and Curved Vanes, Jet Striking Centrally and at Tip-Velocity Triangles at Inlet and Outlet - Expressions for Work done and Efficiency – Angular Momentum Principle – Applications to Radial Flow Turbines – Jet Propulsion of Ships.

UNIT - II

Hydraulic Turbines: Introduction - Classification of Water Turbines – Pelton Wheel – Work done and Working Proportions, Francis, Kaplan and Propeller Turbines- Draft Tubes – Types -Theory –Governing of Turbines- Surge Tanks.
Performance of Turbines: Performance Under Unit Head-Unit Quantities- Performance Under Specific conditions – Specific Speed - Performance Characteristic Curves – Cavitation – Selection of Turbines.

UNIT - III

Reciprocating Pumps: Introduction-Main components and working of a Reciprocating pump-Types -Work done by Reciprocating pump-Single Acting & Double Acting Pump-Coefficient of Discharge – Slip-Percentage Slip And Negative Slip- Indicator diagram – Effect of Acceleration Of Piston On Velocity &Pressure in suction and delivery pipes – Air vessels – Rate of flow into and from air vessels

UNIT - IV

Centrifugal Pumps: Types Component parts and Working – Work done by the Impeller-Manometric head –Losses and Efficiencies – Effect of Vane Angle on Manometric Efficiency – Effect of Finite number of vanes of the Impeller on Head and Efficiency – Minimum Starting Speed – Loss of Head due to reduced or increased flow – Diameters of impeller and pipes-Specific Speed – Multistage Pumps – Pumps in parallel — NPSH – Cavitation

UNIT - V

Hydraulic Devices: Hydraulic Accumulator- Hydraulic Intensifier- Hydraulic Ram- Hydraulic Press- Hydraulic Lift- Hydraulic Crane – Hydraulic Couplings and Torque Converters – Air Lift Pump.

TEXT BOOK

Hydraulic Machine /Fluid mechanics including Hydraulics Machines / Modi & Seth – standard book house.

REFERENCES

1. Elements of Hydraulic Machines and Fluidics / Jagdish Lal
2. Hydraulic Turbines / Nechleba M
3. Introduction to Fluid Mechanics and Fluid Machines, Som,S.R, & Biswas, Tata McGraw Hill,1998
4. Agarwal, S.K., Fluid Mechanics and Machinery, Tata Mc Graw Hill Co., 1997.

T242 - MACHINE TOOLS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

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, specification of lathe – Types of lathes – Work holders and tool holders –Lathe accessories- Box tools -Taper turning-Thread turning and lathe attachments.
Turret and Capstan Lathes: Collet chucks – Other work holders –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:– Principles 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.
Different types of abrasives – bonds specification of grinding wheel and selection of grinding wheel

UNIT - V

Lapping, Honing and Broaching Machines: Comparison to grinding – lapping and honing. Constructional features of speed and feed units, machining time calculations
Principles of Design of Jigs and Fixtures: Uses.-Classification of Jigs & Fixtures – Principles of location and clamping – Types of clamping & work holding devices. Typical examples of jigs and fixtures.

TEXT BOOK
Production Technology by R.K. Jain and S.C. Gupta.

REFERENCES
1. Workshop Technology – B.S.Raghu Vamshi – Vol II
2. Production Technology by H.M.T. (Hindustan Machine Tools).
3. Manufacturing Science by Gosh and Malik
4. Manufacturing Engineering & Technology by Kalpakjain S /Pearson Education

T221 - INDUSTRIAL MANAGEMENT

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	:	External Marks	: 75
Credits	: 3	External Examination	: 3 Hrs

AIM

To make the student to understand concepts and contributions of Management, types of Organizations and also prepare them to have knowledge of several types of managements conducted in Industrial Organizations.

UNIT - I

Introduction

Management- Definition, Nature, importance and Functions of Management-Taylor's Scientific Management Theory, Fayol's Principles of Management, Contribution of Elton Mayo, Maslow, Herzberg, Douglas Mc Gregor. Basic concepts of Organization – Authority, Responsibility, Delegation of Authority, Span of Control, Departmentation and Decentralization-Organization 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: Manpower planning, Recruitment, Selection, Training and Development, Placement, Wage and Salary Administration, Promotion, Transfer, 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 the project within given time, Project Cost Analysis, Project Crashing (simple problems).

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TEXT BOOK

Dr. Aryasri: Management Science, TMH, 4th edition, 2009.

REFERENCES

1. Koontz and Weihrich – Essentials of Management, TMH, 8th edition, 2010
2. Stoner, Freeman, Gilbert, Management, 6th Ed, Pearson Education, New Delhi, 2004
3. O.P.Khana, Industrial Engineering and Management
4. L.S. Srinath, PERT & CPM

P834 - FLUID MECHANICS AND HYDRAULIC MACHINES LAB

		Internal Marks	**: 25**
Lab/Practicals	**: 3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

Any of the 10 Experiments are required to be conducted

1. Verification of Bernollious Theorem
2. Calibration of Venturimeter
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

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P849 - MACHINE TOOLS AND MODELING LAB

		Internal Marks	**: 25**
Lab/Practicals	**: 3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

Any of the 10 Experiments are required to be conducted

MACHINE TOOLS LAB

1. Introduction of general purpose machines -Lathe, Drilling machine, Milling machine, Shaper, Planing machine, slotting machine, Cylindrical Grinder, surface grinder and tool and cutter grinder.
2. Step turning and taper turning on lathe machine
3. Thread cutting and knurling on -lathe machine.
4. Drilling and Tapping
5. Shaping and Planing
6. Slotting
7. Milling
8. Grinding of Tool angles.

MODELING LAB

1. Introduction to a modeling package:
   Protrusion-cut-sweep-revolve-Draft and Loft-Modify/edit-Pattern-Transformation-Boolean opearations.

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

PACKAGES

ProE/CATIA/UniGraphics.

REFERENCES

Lab Manuals

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VI-SEMESTER

T211 - HEAT TRANSFER

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

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 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-Heat flow through Composite Wall and Cylinder - Critical radius of insulation for Cylinder.

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 .
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.

UNIT - III

Convective Heat Transfer: Introduction-Types of Convection- Convective heat transfer coefficient- Dimensional analysis -Buckingham Pi Theorem applied to Forced convection -- Significance of Non Dimensional numbers-The boundary layer concept-The velocity and Thermal boundary layers.
Forced Convection: External Flow-Laminar and Turbulent Flow over a Flat plate –Internal Flow through Circular pipe-Laminar and Turbulent Flows-Entry length and Fully developed flow - Reynolds Colburn analogy
Natural Convection: Development of Hydrodynamic and thermal boundary layer along a Vertical plate- Empirical correlations for Vertical plate , Vertical Cylinder, Horizontal Plate and Horizontal Cylinder.

UNIT - IV

Boiling and Condensation: Boiling 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-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

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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.

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

TEXT BOOK

Fundamentals of Engineering Heat and Mass Transfer – R.C. Sachdeva –New Age Intl. Publishers 2nd Edn., 2005

REFERENCES

1. Heat and Mass Transfer- A Basic Approach—Necati Ozisik –McGrawHill
2. Heat Trasnfer – C. J. Cengel - TMH
3. Heat transfer - J.P.Holman, McGrawHill
4. Heat and Mass Transfer- P.K. Nag –TMH 2nd Edn., 2007
5. Heat Transfer by P.S Ghoshdastidar- Oxford University Press.

T240 - MACHINE DESIGN –II

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

Machine Design Data Books are Permitted

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 loading of ball and roller bearings – Dynamic capacity - Bearing life.

UNIT - II

ENGINE PARTS:
PISTON: Forces acting on piston – Construction -Design and proportions of piston- Cylinder- Cylinder liners.
CONNECTING ROD: Thrust in connecting rod –Rankine's formula-Johnson's formula- Stress due to whipping action on connecting rod ends
CRANK SHAFT: Strength and proportions of center crank shaft– Crank pins

UNIT - III

PULLEYS: Flat belt pulleys – Materials –Design of pulleys for flat belt drive-Types of V- belts – Designation of V-belts – Design of V-grooved pulley.
WIRE ROPES: Introduction- Construction- Designation of wire ropes – Classification – Selection of wire rope – Stresses in hoisting ropes.

UNIT - IV

MECHANICAL SPRINGS: Helical compression springs – Springs for fatigue loading - Natural frequency of helical springs –Energy storage capacity– Tension springs- Helical Torsion springs-Co-axial springs- Leaf springs.

UNIT - V

SPUR & HELICAL GEARS: Spur gears- Helical gears –Lewis equations - Bending strength – 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 procedure – Problems.

TEXT BOOK

Shigley J.E / Mechanical Engineering Design / McGraw-Hill

REFERENCES

1. Sundararajamoorthy, T.V and Shanmugam. N / Machine Design / Anuradha Agencies
2. Machine Design, V.B.Bandari/ McGraw-Hill.
3. Machine Design / R.N. Norton.
4. Data Books : (i) P.S.G. College of Technology (ii) Mahadevan

T333 - UNCONVENTIONAL MACHINING PROCESSES

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

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

UNIT - II

Mechanical Processes
Basic principle, equipment, process variable and applications of ultrasonic machining, abrasive jet machining and water jet machining.

UNIT - III

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.

UNIT - IV

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 - V

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.

TEXT BOOK

Modern Machining Process / Pandey P.C. and Shah H.S./ TMH.

REFERENCES

1. Unconventional manufacturing processes/ M.K.Singh/ New age international
2. Advanced machining processes/ VK Jain/ Allied publishers.

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T290 – PROFESSIONAL ETHICS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

ENGINEERING ETHICS

Senses of 'Engineering Ethics' variety of moral issued types of inquiry moral dilemmas moral autonomy Kohlberg's theory Gilligan's theory consensus and controversy – Models of Professional Roles theories about right action Selfinterest 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 – SelfConfidence – Character – Spirituality

UNIT - III

ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as experimentation engineers as responsible experimenters codes of ethics a balanced outlook on law the challenger case study

UNIT - IV

SAFETY, RESPONSIBILITIES AND RIGHTS

Safety and risk assessment of safety and risk risk benefit analysis and reducing risk the three mile island and chernobyl case studies. Collegiality and loyalty respect for authority collective bargaining confidentiality conflicts of interest occupational crime professional rights employee rights Intellectual Property Rights (IPR) discrimination.

UNIT - V

GLOBAL ISSUES

Multinational corporations Environmental ethics computer ethics weapons development engineers as managersconsulting engineersengineers as expert witnesses and advisors moral leadershipsample code of Ethics (Specific to a particular Engineering Discipline).

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in engineering", McGraw Hill, New York 1996.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, " Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education/ Prentice Hall, New Jersey,2004 (Indian Reprint now available)
2. 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)
3. John R Boatright, " Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, " Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.

T268 - OPERATIONS RESEARCH

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

Introduction to Operations Research, operations research models, applications.
Allocation: Linear Programming Problem Formulation, Graphical solution, Simplex method, artificial variables techniques, Two–phase method, Big-M method, Duality Principle.

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.

UNIT - IV

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.
Inventory: Single item Deterministic models – Purchase inventory models with one price break and multiple price breaks – shortages are not allowed – Stochastic models – demand may be discrete variable or continuous variable – Instantaneous production. Instantaneous demand and continuous demand and no set up cost.

UNIT - V

Project Management: Network Modeling, Probabilistic model, various types of activity times estimation, programme evaluation review technique(**PERT**), critical path method(**CPM**).
Dynamic Programming: Bellman's Principle of optimality, Applications of dynamic programming, capital budgeting problem, shortest path problem, linear programming problem.

TEXT BOOK

Operations Research / Paneer Selvam.

REFERENCES

1. Introduction to O.R/Hiller & Libermann (TMH).
2. Operations Research /A.M.Natarajan, P.Balasubramani, A. Tamilarasi / Pearson Education.
3. Operations Research / Wagner/ PHI Publications.
4. O.R/Wayne L.Winston/Thomson Brooks/cole.
5. Introduction to O.R /Taha/PHI.

T276 - POWER PLANT ENGINEERING

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

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 Plants: 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 BOOK

A course in Power plant engineering- Arora & Domkundwar—Dhanpat Rai & Co

REFERENCES

1. An Introduction To Power Plant Technology, G.D. Rai, Khanna Publishers.
2. A Text Book on Power System Engineering", by A. Chakraborthy, M.L,Soni, P.V. Gupta, U. S. Bhatnagar, Dhanpat Rai & CO.
3. Power plant technology, M.M. El Wakil, TMH.
4. Power plant engineering, G.R. Nagpal, Khanna Publishers.

T248 - MECHANICAL VIBRATIONS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

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 BOOK

Mechanical vibrations/ G.K.Grover/ Nem chand & Bros.

REFERENCES

1. Theory of vibrations/W.T.Thomson/CBS Publishers.
2. Mechanical vibrations/William W.Seti/ Schaum outline series
3. Mechanical vibrations/V.P.Singh/Dhanpat Rai & Sons.
4. Mechanical Vibrations/S.S.Rao/Pearson Education

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T228 - INTRODUCTION TO AEROSPACE ENGINEERING

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

History, Fundamental Thoughts-Fundamental Physical Properties of Flowing Gas, Sources of Aerodynamics Forces, Perfect Gas, Anatomy of AirplaneStandard Atmosphere: Altitude, Hydrostatic Equation, Geopotential, Geoaltitude, Standard Atmosphere

UNIT - II

Aerodynamics: Introduction, Fundamental Concepts of Aerodynamics, Airfoil Nomenclature, Wing Geometry, Aerodynamic Forces, Lift, Drag and Moment Coefficients, Pressure Distribution on Airfoil, Types of Drag, Basic Concepts of Compressible Flow.

UNIT - III

Aircraft Performance: Introduction: The Drag Polar, Equations of Motion, Thrust Required for Level, Unaccelerated Flight, Thrust Available and Maximum Velocity, Power Required for Level, Power Available and Maximum Velocity, Altitude Effects on Power Required and Available, Rate of Climb, Gliding Flight, Absolute and Service Ceilings, Time to Climb, Range and Endurance

UNIT - IV

Propulsion: Introduction, Propeller, Reciprocating Engine, Jet Propulsion-The Thrust Equation, Turbojet Engine, Turbofan Engine, Ramjet Engine, Rocket Engine, Rocket Propellants-Liquid Propellants, Solid Propellants, Rocket Equation, Rocket Staging

UNIT - V

Aircraft Structure and Material: Introduction, Some Physics of Solid Materials, Some Elements of an Aircraft Structure- Beams- Box Structures, Monocoque and Semi-Monocoque Structures, Aircraft Materials.

TEXT BOOK

Introduction to Flight, John D. Anderson, Jr., McGrawHill

REFERENCES

1. Aerodynamics for Engineering Students, Houghton and Carpenter
2. Mechanics of Flight, A.C. Kermode,

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T332 - TRIBOLOGY

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

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, Reynold's equation in two dimensions, bearing modulus, Sommerfield 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 bearings and **Bearing materials :** Anti-friction bearings, types, Advantages and disadvantages, General requirements of bearing materials, types of bearing materials, General bearing design considerations.

TEXT BOOK

Fundamentals of Tribology, Basu, SenGupta and Ahuja/PHI.

REFERENCES

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

T331 - TOTAL QUALITY MANAGEMENT

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

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

Dale H. Besterfiled, et al., Total Quality Management, Pearson Education, 2003.

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, 1991.
3. Narayana V. and Sreenivasan, N.S, Quality Management- Concepts and Tasks, New Age International, 1996.
4. Zeiri, Total Quality Management for Engineers, Wood Head Publishers, 1991.

T270 - OPTIMIZATION TECHNIQUES

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

OBJECTIVE

This course is a basic mathematical tool in solution of number of system operational methods and design of components and systems. The course also contains non-traditional optimization techniques like Genetic Algorithms and Particle Swarm methods. The contents of this course are also widely used in operations research in systems planning and management.

UNIT - I

Linear Programming (LP)
Introduction through engineering applications, standard form of LP problem (LPP), Geometrical interpretation, simplex method and algorithm, two phases of simplex method, Numerical problems, Revised simples method, Duality in LP, Dual simplex method, sensitivity analysis.

UNIT - II

Applications and extensions of LP
Transportation problem, Assignment problem, Karmarkar's method, Quadratic programming and Engineering Applications.

UNIT - III

Non-linear Programming – Unconstrained minimization
Interpolation methods, quadratic and cubic interpolation methods, Newton's method.Gradient Methods – Steepest descent, conjugate gradient, Newton's and quasi Newton methods, Davidon-Flecher-Powell method, numerical problems.

UNIT - IV

Non-linear Programming – Constrained Minimization
Legrangian multipliers, Kuhn-Tucker conditions, sequential LP method, methods of feasible directions, Rosen's gradient projection method, Generalized reduced gradient method, Interior and exterior penalty function methods.

UNIT - V

Dynamic Programming & Non-traditional Optimization
Principle of optimality, computational procedure, applications from engineering. Evolutionary Programming Techniques – Genetic Algorithm (GA), the three parameters of GA, computational procedure for both binary and analogue coded inputs. Introduction to Particle swarm Optimization. Numerical examples.

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TEXT BOOKS

1. "Engineering Optimization – Theory and Practice", S.S. Rao, III Edition, John Wiley & Sons 1996 and New Age International Pvt Ltd., New Delhi, 2002.
2. "Optimization for Engineering Design - Algorithms and Examples", Kalyanmoy Deb, PHI Learning Private Ltd, New Delhi, 1995.

REFERENCES

1. "Optimization Methods in Operations Research and Systems Analysis", K.V. Mittal and C Mohan, II edition 1983, New Age International Publishers, New Delhi.
2. "Combinatorial Optimization – Algorithms and Complexity", Christos H Papadimitriou and Kenneth Steiglitz, Prentice Hall of India 1997.
3. "Introduction to Optimization & Operations Research", J C Pant, IV Edition, Jain Brothers, New Delhi.
4. "Genetic Algorithms in Search, optimization and machine learning: Reading, Mass", D.E. Goldberg, Addison-Wesley, 1989.
5. "Swarm Intelligence", Kennedy, J. and Eberhart, R.C., 2001, Morgan Kaufm

P836 - HEAT TRANSFER LAB

		Internal Marks	**: 25**
Lab/Practicals	**: 3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

Any of the 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.

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P844 - MECHANICS OF MACHINES LAB

		Internal Marks	**: 25**
Lab/Practicals	**: 3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

Any of the 10 Experiments are required to be conducted

LIST OF EXPERIMENTS

1. To determine gyroscopic couple on Motorized Gyroscope
2. To find the coefficient of friction between belt and pulley
3. To determine the endurance strength of specimen using rotating beam machine
4. Determination of transmission efficiency of gear reducers
5. To find the stability and sensitivity of Watt governor
6. To find the stability and sensitivity of Porter governor
7. To find the transverse vibrations of free-free beam
8. Balancing of rotating masses
9. Balancing of reciprocating masses
10. Determination of damping coefficient of single degree of freedom system using spring mass system
11. Determination of critical speed of shaft with concentration loads
12. Determine the moment of inertial of connecting rod by compound pendulum method
13. Determine the moment of inertial of flywheel by oscillation
14. To study various types of cam and follower mechanisms
15. To study inversions of four bar mechanisms, single and double slider crank mechanisms
16. To study various types of gear trains- simple, compound, reverted, epicyclic and differential.
17. To study the working of screw jack and determine its efficiency

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VII-SEMESTER

T203 - FINITE ELEMENT METHOD

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**: 1 Period/Week**	**External Marks**	**: 75**
Credits	**: 5**	**External Examination**	**: 3 Hrs**

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- Pascal triangle –Pascal pyramid-Potential Energy approach - Assembly of Global stiffness matrix and load vector-Finite element equations- Treatment of boundary conditions

UNIT - II

Analysis of Beams: Element stiffness matrix for two nodes, two degrees of freedom per node beam element Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions.

UNIT - III

Finite element modeling of axisymmetric solids subjected to axisymmetric loading with triangular elements. Two dimensional four noded isoparametric elements and numerical integration-Gauss quadrature

UNIT - IV

One dimensional steady state heat transfer analysis of a fin-Element conductivity matrix-Convection matrix-Heat rate vector. 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-element matrices-evaluation of eigen values and eigen vectors for a stepped bar and a beam.

TEXT BOOK

Introduction to Finite Elements in Engineering / Chandraputla, Ashok and Belegundu / Prentice – Hall

REFERENCES

1. An introduction to Finite Element Method / JN Reddy / Me Graw Hill
2. The Finite Element Methods in Engineering / SS Rao / Pergamon
3. The Finite Element Method for Engineers – Kenneth H. Huebner, Donald L. Dewhirst, Douglas E Smith and Ted G. Byrom / John Wiley & sons (ASIA) Pte Ltd.
4. Finite Element Analysis/ C.S.Krishna Murthy

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T132 - CAD/CAM

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

Fundamentals of CAD: Introduction – The design process – The application of computers for design- Creating the manufacturing data base – Benefits of CAD.
Computer Graphics: Introduction – Software configuration of graphics system – Functions of a Graphics package – Transformations: Translation, scaling, reflection, rotation, Concatenated transformation.

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: Introduction, surface models surface entities, parametric representation of analytical surfaces- parametric representation of Bezier and B-Spline surfaces
Representation of solids: Introduction, solid models, solid entities, Solid representation, Fundamentals of solid modeling, Boundary representation, CSG 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 – parts classifications and cooling – 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 – the computers in Q C – 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.

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TEXT BOOK

Ibrahim Zeid, CAD/CAM theory and practice, TATA MC Graw Hill publishing CO.Ltd, New Delhi.

REFERENCES

1. Mikell P.Groover and Emory W.Zimmers, CAD/CAM- prentice Hall of India private LTD. New Delhi
2. PN Rao, CAD/CAM Principle and Applications, Tata MC Graw Hill Education Private Ltd, New Delhi.
3. P.Radhakrishnan, S.Subramanyan &V.Raju, CAD/CAM/CIM, New Age International Publishers

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T251 - METROLOGY

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

Linear Measurement: Standards of measurements- line and end standard. Basic principle and applications of slip gauges, dial indicator and micrometers.
Angular Measurement: Bevel protractor – angle slip gauges – spirit levels – sine bar, rollers and spheres used to determine the tapers
Flat Surface Measurement: Basic principle of straight edges and surface plates.

UNIT - II

Optical Measuring Instruments: Tool maker's microscope and its uses – collimators, optical projector – optical flats and their uses, interferometer.
Comparators: Basic principle and applications of – mechanical, electrical, electronic and pneumatic comparators.

UNIT - III

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
Limit Gauges: Taylor's principle – Design of go and No go gauges, plug, ring, snap, profile and position gauges

UNIT - IV

Surface Texture: Factors effecting surface roughness, reasons for controlling surface texture, Differences between surface roughness and surface waviness, -Numerical assessment of surface finish – CLA, R, R.M.S Values – Ra values, and Rz values. Basic principle of profile meter and Talysurf. ISI symbols for indication of surface finish.
Screw Thread Measurement: Screw thread terminology, errors in screw threads – measurement of various elements of screw threads-Major diameter, minor diameter, effective diameter, pitch, flank angle and thread form.

UNIT - V

Machine Tool Alignment Tests: Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling, drilling machine tools..
Gear Measurement: Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch, pressure angle and tooth thickness. Parkinson's gear tester.
Coordinate Measuring Machines: Basic principle, types and applications of CMM.

TEXT BOOK

Engineering Metrology / R.K. Jain / Khanna Publishers.

REFERENCES

1. Engineering Metrology / I C Gupta / Danpath Rai
2. A text book of Metrology /M. Mahajan/ Dhanpat Rai & Co

T297 - REFRIGERATION AND AIR CONDITIONING

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	: 1 Periods/week	External Marks	: 75
Credits	: 4	External Examination	: 3 Hrs

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.
Refrigerants: Classification of refrigerants- Desirable properties-Nomenclature-Commonly used refrigerants- Alternate refrigerants.
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.

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 Vapor compression cycle
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.
Steam Jet Refrigeration System: Principle of working –Analysis- Applications.

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 must be supplied in the exam hall.

TEXT BOOK
Refrigeration and air conditioning - C. P. Arora. - TMH

REFERENCES
1. A course in refrigeration and air conditioning - S. C. Arora, Domkundwar.- Dhanapat Rai
2. Refrigeration and Air conditioning - Manohar Prasad - TMH
3. Principles of Refrigeration - R. Dossat- Pearson Edn. Refrigeration and Air Conditioning, Arora, Ramesh Chandra, PHI

T247 - MECHANICAL MEASUREMENTS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

UNIT - I

Basic Concepts: Introduction, Fundamental Methods of Measurement, Basic Elements of Measurement system, Performance Terms, Basic Concepts in Dynamic Measurements
Analysis of Experimental Data: Causes and Types of Experimental Errors, Uncertainty Analysis, Method of Least Squares, Graphical Analysis and Curve Fitting

UNIT - II

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.
Measurement of Displacement: Introduction, Classification, Dimensional Measurement, Gage Blocks, Optical Methods, Pneumatic Gage,
Measurement of Force and Torque: Introduction, Elastic Transducer, Strain Gage Load Cells, Dynamometers- Mechanical, Hydraulic, Electrical

UNIT - III

Measurement of Pressure: Introduction, Barometers, Manometers, Dial type pressure gauge, Pressure Transducers, Pitot, Static, and Pitot-Static Tube and Its characteristics,Low Pressure Measurement Gauges
Measurement of Fluid Flow: Introduction, Rotameter, Turbine flow meter, Laser Doppler Anemometer,
Hot-wire Anemometer, Flow Visualization Methods

UNIT - IV

Measurement of Temperature: Introduction, Types of thermometers, Thermocouples, RTD, Thermisters, Pyrometers
Measurement of Humidity: Introduction, Sling psychrometer, Absorption psychrometer, Dew point meter.

UNIT - V

Measurement of Speed: Mechanical Tachometers – Electrical tachometers – Stroboscope, Noncontact
type of tachometer
Measurement of Motion and Vibration: Introduction, Elementary Vibrometers, Elementary Accelerometer, Principles of Seismic instruments, Sound Measurement

TEXT BOOK

Mechanical Measurements, BeckWith, Marangoni,Linehard, Person Education Asia

REFERENCES

1. Experimental Methods for Engineers , J.P. Holman, McGraw Hill
2. Ernest O. Doebelin, *Measurement systems Application and Design*, International Student Edition, IV Edition, McGraw-Hill Book Company, 1998
3. Instrumentation, Measurements and Experiments in Fluids, E. Rathakrishnan, CRC press, 2007.

T324 - THEORY OF ELASTICITY

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

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 Venent'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 spherical and deviatoric stress - Hydrostatic strain.

UNIT - IV

General theorems: Differential equations of equilibrium and compatibility - 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 BOOK

Timeshenko & Goodier, Theory of Elasticity - McGraw Hill

REFERENCES

1. Applied stress analysis by Dr.Sadhu Singh, Khanna Publishers
2. Theory of Elasticity by A.I.Lurie, Springer
3. Experimental stress analysis by Dally and Riley,Mc Graw-Hill
4. A treatise on Mathematical theory of Elasticity by LOVE .A.H, Dover publications Inc
5. Theory of Elasticity by A.Meceri, Springer
6. Applied Elasticity by W.T. Wang.

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T126 - AUTOMOBILE ENGINEERING

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

Introduction: Components of Four Wheeler Automobile-The Basic Structure-Power Unit-Power Transmission - Rear Wheel Drive- Front Wheel Drive- Four Wheel Drive-Types of Automobiles.
Engine: Basic Terminology- Types- firing order- Engine Construction Details-Engine Service- Reboring.

UNIT - II

Fuel Supply Systems in Petrol Engines: Fuel Supply Systems- Fuel pumps- Mechanical and Electrical pumps –Fuel Filters- Functions of Carburettor-Simple Carburettor-Defects in Simple Carburttor-Types of Modern Carburettors- Zenith Type-S.U.Type-Petrol Injection-Multi Point Fuel Injection System.
Fuel Supply Systems in Diesel Engines: Requirements of Diesel Injection System-Types of Injection Systems-Fuel Feed Pump-Fuel Injection Pump-Fuel Injector-Types of Nozzles-Air Cleaners.

UNIT - III

Engine Cooling Systems: Need- Air cooling - water cooling-Thermo-syphon - forced circulation- Radiator- Thermostat- Pressure Sealed Cooling- Antifreeze solutions.
Engines Lubricating Systems : Necessity –Types- Petroil- Splash – Pressure lubrication systems- Oil Pumps- Crankcase ventilation.
Ignition System: Functions-Battery Ignition system-Magneto coil Ignition System- Electronic Ignition.

UNIT - IV

Electrical System: Starting System-Bendix Drive Mechanism-Soleniod Switch- lighting System-Horn-Wiper.
Transmission: Clutches-Priniciple-Types-Cone Type- Single-plate and Multi-plate clutches-Centrifugal clutches-Gear Boxes-Types-Sliding Mesh-Constant Mesh- synchromesh type automatic transmission- overdrive- propeller shaft- Hotch Kiss Drive-Differential

UNIT - V

Steering System: Steering Geometry-Camber-Castor-King Pin Rake- Combined Angle-Toe-In- Center Point Steering-Steering Gears-Types-Power Steering, Wheel Alignment
Suspension Systems: Need for Suspension systems- Torsion bar-shock absorbers-Air Suspension.
Braking Systems: Types of Brakes –Mechanical-Hydraulic-Air Brakes.

TEXT BOOKS

1. Automobile Engineering - - Vol I & II - Kirpal Singh , Standard Publications
2. Automotive Mechanics - Joseph Heitner ,CBS Publishers.

REFERENCES

1. Automobile Engineering- G. B. S. Narang, Khanna Publishers.
2. Automobile Engineering – R.B .Gupta

T249 - MECHATRONICS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

Introduction : Definition – Trends - Control Methods: Standalone , PC Based (Real Time Operating Systems, Graphical User Interface , Simulation) - Applications: SPM, Robot, CNC, FMS, CIM.
Signal Conditioning : Introduction – Hardware - Digital I/O , Analog input – ADC , resolution , sped channels.
Filtering Noise using passive components – Resistors, capacitors - Amplifying signals using OP amps – Software - Digital Signal Processing – Low pass , high pass , notch filtering

UNIT - II

Precision Mechanical Systems : Pneumatic Actuation Systems - Electro-pneumatic Actuation Systems - Hydraulic Actuation Systems - Electro-hydraulic Actuation Systems - Timing Belts – Ball Screw and Nut - Linear Motion Guides - Linear Bearings - Harmonic Transmission - Bearings- Motor / Drive Selection.

UNIT - III

Electronic Interface Subsystems : TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids , motors Isoation schemes- opto coupling, buffer IC's - Protection schemes – circuit breakers , over current sensing , resetable fuses , thermal dissipation - Power Supply - Bipolar transistors / mosfets
Electromechanical Drives : Relays and Solenoids - Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation.

UNIT - IV

Microcontrollers Overview : 8051 Microcontroller , micro processor structure - Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming –Assembly , C (LED Blinking , Voltage measurement using ADC).
PROGRAMMABLE LOGIC CONTROLLERS : Basic Structure - Programming : Ladder diagram - Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection - Application.

UNIT - V

Programmable Motion Controllers : Introduction - System Transfer Function – Laplace transform and its application in analysing differential equation of a control system - Feedback Devices : Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors : Inductive , Capacitive, Infrared - Continuous and discrete processes - Control System Performance & tuning - Digital Controllers - P , PI , PID Control - Control modes – Position , Velocity and Torque - Velocity Profiles – Trapezoidal - S. Curve - Electronic Gearing - Controlled Velocity Profile - Multi axis Interpolation, PTP , Linear , Circular - Core functionalities – Home , Record position , Go to Position - Applications : SPM, Robotics.

TEXT BOOKS

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering by W Bolton,Pearson Education Press, 3rd edition, 2005.
2. Mechatronics/M.D.Singh/J.G.Joshi/PHI.

REFERENCES

1. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
2. Mechatronics – N. Shanmugam / Anuradha Agencies Publisers.
3. Mechatronics System Design / Devdas shetty/Richard/Thomson.

T124 - AUTOMATION IN MANUFACTURING

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	:	External Marks	: 75
Credits	: 3	External Examination	: 3 Hrs

UNIT - I

Introduction: Production System Facilities, Manufacturing Support systems, Automation in Production systems, Automation principles & Strategies **Manufacturing Operations:** Manufacturing Operations, Product/Production Relationship, Production concepts and Mathematical Models & Costs of Manufacturing Operations

UNIT - II

Automated Flow Lines : Methods or work part transport transfer Mechanical buffer storage control function, design and fabrication consideration. Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines

UNIT - III

Automated Manufacturing Systems: Components of a Manufacturing systems, Classification of Manufacturing Systems, overview of Classification Scheme, Single Station Manned Workstations and Single Station Automated Cells.

UNIT - IV

Automated Material Handling : Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems. Automated storage systems, Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT - V

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 BOOK

Automation, Production systems and computer Integrated Manufacturing : M.P. Groover/ PE/ PHI

REFERENCES

1. Computer control of Manufacturing Systems by Yoram Coreom.
2. CAD/ CAM / CIM by Radhakrishnan.
3. Automation by W.Buekinsham.

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T148 – CONTROL SYSTEMS

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	:	External Marks	: 75
Credits	: 3	External Examination	: 3 Hrs

OBJECTIVE

In this course it is aimed to introduce to the students the principles and applications of control systems in everyday life. The basic concepts of the block diagram reduction, time domain analysis solutions to time invariant systems and also deals with the different aspects of stability analysis of systems in frequency domain and time domain.

UNIT - I

Control system modeling
Concepts of control systems- Open loop and closed loop control systems. Characteristics of feedback control systems: System concept, differential equations and transfer functions. Modeling of electric systems, translational and rotational mechanical systems, and Simple electromechanical systems. Block diagram representation of systems – Block diagram reduction methods – Closed loop transfer function, determination of signal flow graph. Mason's gain formula Control System Components: Stepper motors – AC servo motor – DC servo motor – Synchros.

UNIT - II

Time domain analysis
Test signals – time response of first order and second order systems – time domain specifications – types and order of systems – generalized error co-efficient – steady state errors – concepts of stability – Routh-Hurwitz stability – root locus.

UNIT - III

Frequency domain analysis
Introduction – correlation between time and frequency response – stability analysis using Bode plots, Polar plots, Nichols chart and Nyquist stability criterion – Gain margin – phase margin.

UNIT - IV

Compensators
Realization of basic compensators – cascade compensation in time domain and frequency domain and feedback compensation – design of lag, lead, lag-lead compensator using Bode plot and Root locus. Introduction to P, PI and PID controllers.

UNIT - V

State variable analysis
State variable methods - introduction to the state variable concept - state space models - physical variable - phase variable and diagonal forms from time domain - diagonalisation - solution of state equations - homogenous and non homogenous cases- properties of state transition matrix - relation between transfer function and state space models , Controllability and Observability.

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TEXT BOOKS

Modern Control Engineering, Ogata.K, Prentice Hall of India, 5th Edition.

REFERENCES

1. Automatic Control Systems, Benjamin.C.Kuo, 7th Edition – Prentice Hall of India, 2002.
2. Control Systems, M.Gopal, Tata McGraw-Hill, 1997.
3. "*Modern Control Systems*", Dorf R.C. & Bishop R.H., Addison Wesley.
4. Control System Engineering, 3rd Edition, Nagrath & Gopal, New Age International Edition, 2002.

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P807 - CAD / CAM LAB

		Internal Marks	**: 25**
Lab/Practicals	**: 3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

Any of the 10 Experiments are required to be conducted

1. Assemble Modeling (At least three examples))
2. Determination of deflection and stresses in 2D and 3D trusses and beams.
3. Determination of deflection and stresses in plane stress, plane strain and Axi-symmetric components.
4. Determination of stresses in 3D structures.
5. Determination of stresses in shell structures
6. Estimation of natural frequencies and mode shapes Harmonic response on 2D beam.
7. Estimation of natural frequencies and mode shapes, Harmonic response of2D beam.
8. Steady state heat transfer Analysis of plane and Axi -symmetric components,
9. Study of various post processors used in NC Machines.
10. Development of NC code for free form and sculptured surfaces using CAM packages.
11. Machining of simple components on NC lathe and Mill by transferring NC Code /from a CAM package. Through RS 232.

PACKAGES

ANSYS/NASTRAN/CATIA/ProE etc.

REFERENCES

Lab Manuals

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P850 - METROLOGY AND INSTRUMENTATION LAB

		Internal Marks	**: 25**
Lab/Practicals	**: 3 Period/Week**	**External Marks**	**: 75**
Credits	**: 2**	**External Examination**	**: 3 Hrs**

Any of the 10 Experiments are required to be conducted

METROLOGY

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.
6. Machine tool alignment test on milling machine.
7. Tool makers microscope and its application
8. Angle and taper measurements by Bevel protractor, Sine bars, etc.
9. Use of spirit level in finding the flatness of surface plate.
10. Thread measurement by Three wire method or Tool makers microscope.
11. Surface roughness measurement by Taly Surf.

INSTRUMENTATION

1. Calibration of Pressure Gauges
2. Calibration of transducer for temperature measurement.
3. Study and calibration of LVDT transducer for displacement measurement.
4. Calibration of strain gauge for temperature measurement.
5. Calibration of thermocouple for temperature measurement.
6. Calibration of capacitive transducer for angular displacement.
7. Study and calibration of photo and magnetic speed pickups for the measurement of speed.
8. Calibration of resistance temperature detector for temperature measurement.
9. Study and calibration of a rotometer for flow measurement.
10. Study and use of a Seismic pickup for the measurement of vibration amplitude of an engine bed at various loads.
11. Study and calibration of McLeod gauge for low pressure.

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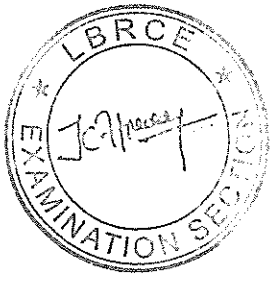
VIII-SEMESTER



T300 - ROBOTICS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 4**	**External Examination**	**: 3 Hrs**

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 – The direct kinematics problem: Rotation matrices, composite rotation matrix about on arbitrary axis , rotation matrix with euler angle representation – Geometric interpretation of rotation matrices, homogeneous coordinates and transformation matrix, geometric interpretation of homogeneous transformation matrices, composite H.T matrix ,Problems- D-H representation – problems on forward kinematics problems on forward kinematics.

UNIT - III

Manipulator jacobian – problems – **Dynamics**: Introduction , 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

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 BOOK

Mikell P.Groover, MITCHELL WEISS, ROGER N. Nagel& NICHOLAS G. Odrey; Industrial Robotics, McGraw- HILL International Editions.

REFERENCES

1. R.K.Mittal and IJ Nagrath, robotics andcontrol ,Tata Mc Graw – Hill publishing company Limited, New Delhi.
2. Robert J.Schilling, Fundamentals of robotics analysis & control, PHI learning private limited, New Delhi
3. Saeed B.Niku, Introduction to robotics analysis systems Application, PHI learning private limited, New Delhi
4. K.S.Fu, R.C Gonzalez and C.S.G.Lee, Robotics control, Sensing, vision, and intelligence; Mc Graw HILL International Editions

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T107 - ADVANCED STRENGTH OF MATERIALS

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	:	External Marks	: 75
Credits	: 3	External Examination	: 3 Hrs

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 nonsymmetrical bending – Deflection of straight beams due to nonsymmetrical 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 – Rankine'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 BOOK

Advanced Mechanics of Materials/ Boresi & Sidebottom/ Wiely International.

REFERENCES

1. Strength of Materials/ Dr. Sadhu Singh / Khanna Publishers
2. Mechanics of Materials / Gere and Timoshenko / CBS Publishers & Distributers
3. Advanced Mechanics of Materials/ Seely and Smith/ John Wiley International Edn.
4. Advanced Mechanics of Solids/ L.S.Srinath /Tata McGraw Hill

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T263 - NON CONVENTIONAL ENERGY SOURCES

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

Introduction: Energy sources and availability, new energy techniques, Renewable energy sources

Solar Energy: Solar constant, Radiation geometry, Extraterrestrial and terrestrial solar radiation –Instruments for measuring solar radiation –Solar radiation on horizontal and tilted surface.

UNIT - II

Solar Energy Collecting Devices:
Solar energy collectors, Concentrated and flat plate, Energy balance and collector efficiency, Solar energy storage, Application to space heating, distillation, Solar heating- air heating system- solar water heating system- forced and natural circulation systems- solar pond – solar stills- solar dryers- commercial and solar heating/cooling systems-solar refrigeration system- cooking and green house effect.

UNIT - III

Wind Energy: Basic principle, site selection, Aerodynamic analysis of blades, Wind energy sources and potentials –Horizontal and Vertical axis Wind Mills performance Characteristics – wind Generators- types – wind energy conversion systems.

Bio-energy: Principles of Biomass conversion technology, photosynthesis, Biogas plant, thermal Gasification - Bio mass –Types of Bio gas Digesters –Combustion characteristics of Bio gas-Bio gas plant Technology and status

UNIT - IV

Energy from ocean: Ocean thermal electric conversion, energy from tides, small scale hydroelectric development- Ocean Energy-principles utilization –OTEC –thermodynamic cycles (Open& Closed Cycle OTEC) -tidal and wave energy

Geothermal Energy: Sources, hydrothermal sources, hot dry rock resources, geothermal fossil system, prime movers for geothermal energy- Geothermal Energy – resources – types of wells – methods of harnessing the energy –potential in India

UNIT- V

Direct Energy Conversion Systems:
Direct energy conversion systems (DECS)-Principles of DECS- Thermo electric generators-seebeck effect- Peltier effect- Thomson effect – fuel cells –Types -Magneto Hydrodynamic Generators (MHD) – principle – Temperature and Ionization – MHD Generators performance- closed and open cycle MHD generators - Photo voltaic conversion system-solar cell configurations – characteristics of solar cells –advantages, disadvantages and limitations of solar photovoltaic cells.

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TEXT BOOK

G.D.Rai, Non Conventional energy Sources, Khanna Publishers

REFERENCES

1. Power plant Engineering by P.K. Nag
2. Renewable energy sources Tiwari and Ghosal/Narosa
3. Non Conventional Energy Systems K.Mittal / Wheeler
4. Non Conventional Energy /Ashok V Desai /Wiley Eastern.
5. Renewab energy source and emerging technologies, kothari, PHI

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T139 - COGNITIVE ENGINEERING

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

Introduction to Cognitive Engineering, Fundamental issues in Cognitive Engineering, Information, Computation, Representation.

UNIT - II

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

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

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 BOOKS

1. Foundations of Cognitive Science, Posner,M.I , MIT Press.
2. A Companion to Congnitive Science, Bechtel,W.& Graham,G, Blackwell publishing.
3. User Interface for all concepts, methods & tools, Stephamidis,C, Lawrence Erlbaum associates.
4. Interaction design beyond human, Sharp,R.P, wiley publishers.

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T208 - GAS DYNAMICS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

Basics of Compressible Flow: Properties of fluids, Thermodynamic Properties, Thermodynamics of fluid flow, Laws of thermodynamics, Perfect gas, Compressibility, Basic Equations of compressible flow- Energy equation, Isentropic flow relations, Stagnation Properties, Speed of sound, Mach Number, Mach angle, Mach cone, Mach wave, Shock wave, Wave propagation

UNIT - II

Steady One-dimensional Flow: Introduction, Fundamental Equations, Discharge from a reservoir, Critical values, Streamtube area-velocity relation, Types of nozzles, Applications of nozzles, Area Mach number relation, Isentropic flow through nozzles, Diffusers

UNIT - III

Waves in Supersonic Flow: Introduction, Types of waves, Normal shock-equations of motion, The normal shock relations for perfect gas, Change of stagnation or total pressure across the shock, Hugoniot equation.
Oblique shock- relations, Relation between β-θ-M, Detached Shocks. Expansion waves, Flow with shocks and expansion waves at the exit of a convergent-divergent nozzle.

UNIT - IV

Prandtle Mayer Flow: Introduction, Thermodynamics considerations, Prandtle Mayer Expansion Fan, Reflections (3)
Flow with Friction and Heat Transfer: Introduction, Flow in constant Area Duct with friction, Adiabatic Constant area flow of a perfect gas, Fanno line Flow, Flow with heating and cooling in ducts, Rayleigh line relation

UNIT - V

Measurements in Compressible Flow: Pressure measurements, Static pressure and Dynamics head measurement in compressible flow, Compressibility correction to dynamics pressure, Pressure coefficient, Temperature measurements, Supersonic flow visualization techniques.

TEXT BOOK

Gas Dynamics, E. Rathakrishnan, Second Edition Prentice Hall of India pvt. Ltd, New Delhi

REFERENCES

1. Fluid Mechanics, An Introduction, E. Rathakrishnan, Prentice Hall of India pvt. Ltd, New Delhi
2. The dynamics and thermodynamics of compressible fluid flow Vol I by Ascher H. Shapiro, The Ronald press Co. New York, 1953
3. Elements of Gas Dynamics, H.W. Liepmann and A. Roshko
4. Thomson P.A, Compressible Fluid Dynamics, McGraw-Hill, New York, 1972
5. Instrumentation, Measurements and Experiments in Fluids, E. Rathakrishnan, CRC press, Taylor and fancies Group.

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T252 - MICRO ELECTRO MECHANICAL SYSTEMS (MEMS)

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	:	External Marks	: 75
Credits	: 3	External Examination	: 3 Hrs

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, Photoresists and Application, Light Sources, Photoresist Removal, Ion Implantation, Diffusion, Oxidation, Chemical Vapor 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
Microsensors: Biomedical Sensors, Chemical sensors, Optical Sensors, Pressure Sensors, Thermal Sensors.
Microactuation: Actuation using thermal forces, Piezolelctric crystals, Electrostatic forces, MEMS with microactuators: Microgrippers, Micromotors, Microgears, Micropumps.

TEXT BOOK

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

REFERENCES

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

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T230 - INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	:	External Marks	: 75
Credits	: 3	External Examination	: 3 Hrs

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

Computational fluid dynamics - Basics with applications - John. D. Anderson / Mc Graw Hill.

REFERENCES

1. Computational Fluid Mechanics and Heat Transfer, Anderson, D.A.,Tannehill, I.I., and Pletcher, R.H.,Taylor and Francis
2. Numerical heat transfer and fluid flow / Suhas V. Patankar- Butter-worth Publishers
3. Fundamentals of Computational Fluid Dynamics, T. K Sengupta, University Press

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T200 - EXPERIMENTAL STRESS ANALYSIS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

Stress: Stress at a point - Stress equations of Equilibrium - Laws of stress transformation - Principal stresses – Maximum Shear stress - Dimensional state of stress.

UNIT - II

Strain Measurement: Strain - its relation to experimental determination - properties of strain Gauge systems - Electrical resistance strain gauges - strain gauge circuits - recording instruments - analysis of strain gauge data.

UNIT - III

Moire Methods: Mechanism of formation of Moire fringe - geometrical approach to Moire fringe analysis - displacement field approach to Moire fringe analysis - out of plane measurements experimental procedure.

UNIT - IV

Photo Elasticity Methods: Temporary double refraction - stress optic law - effects of stressed model in a plane polariscope fringe multiplication - isochromatic fringe patterns - isoclinic fringe pattern compensation techniques – calibration methods - separation methods - scaling model to phototype stresses - materials.

UNIT - V

Birefrigent Coatings: Coating stresses and strains - sensitivity - materials and applications - effect of thickness - stress separation.

TEXT BOOK

Experimental Stress Analysis, James Dalley, W.F.Riley, McGraw Hill

REFERENCES

1. Experimental Stress Analysis, Dove Adams, McGraw Hill
2. Strain Gauge Primer , Perry and Lissiener, McGraw Hill
3. Photomechanics, Durelli, Prentice Hall

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T288 - PRODUCTION PLANNING AND CONTROL

Lecture	: 4 Periods/week	Internal Marks	: 25
Tutorial	:	External Marks	: 75
Credits	: 3	External Examination	: 3 Hrs

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 – folowup – definition – Reason for existence of functions – types of followup, applications of computer in production planning and control.

TEXT BOOK

Operations Management / Joseph Monks.

REFERENCES

1. Elements of Production Planning and Control / Samuel Eilon.
2. Operations Management – S.N. Chary.
3. Modern Production/ operation managements / Baffa & Rakesh Sarin

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T144 – COMPUTER GRAPHICS

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

Introduction: Usage of Graphics and their applications, Presentation Graphics-Computer Aided Design-ComputerArt- Entertainment- Education and Training-Visualization- Image Processing- Graphical User Interfaces. Over view of Graphics systems: Video Display Devices- Raster Scan systems-random scan systems-Graphics monitors and workstations-Input devices.

UNIT - II

Output primitives: Points and Lines-Line Drawing Algorithms- Loading the Frame buffer-Line function- Circle- Generating Algorithms- Ellipse Generating Algorithms-Other Curves-Parallel Curve Algorithms-Curve Functions-Pixel Addressing- Filled Area Primitives-Filled Area Functions.

UNIT - III

Two Dimensional Geometric Transformations: Basic Transformations- Matrix Representations - Homogeneous Coordinates - Composite Transformations - Other Transformations-Transformations between Coordinate Systems - Affine Transformations-Transformation Functions- Raster methods for Transformation.

UNIT - IV

Two Dimensional Viewing: The viewing Pipeline-Viewing Coordinate Reference Frame-Window-to-Viewport Coordinate Transformation-Two Dimensional Viewing Functions-Clipping Operations-Point Clipping-Line Clipping-Polygon Clipping.

UNIT - V

Three Dimensional Concepts and Object representations: 3D display methods-3DGraphics-Polygon Surfaces- Curved Lines and Surfaces- Quadratic Surfaces, Three Dimensional Geometric and Modeling Transformations: Translation-Rotation-scaling-Other Transformations-Composite Transformations-3D Transformation Functions-Modeling and Coordinate Transformations.

TEXT BOOK

1. Donald Hearn & M. Pauline Baker, "Computer Graphics C Version", Pearson Education, New Delhi, 2004 (Chapters 1 to 12 except 10-9 to 10-22 of the Text book)

REFERENCES

1. David F. Rogers; "Procedural Elements for Computer Graphics"; TMH
2. J. D. Foley, S. K Feiner, A Van Dam F. H John; "Computer Graphics: Principles & Practice in C"; Pearson
3. Franscis S Hill Jr; "Computer Graphics using Open GL"; Pearson Education, 2004.

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Dept. of Mechanical Engineering
LAKIREDDY BALI REDDY COLLEGE OF ENGG.
MYLAVARAM - 521 230., KRISHNA DT, A.P.

T261 - NANO TECHNOLOGY

Lecture	**: 4 Periods/week**	**Internal Marks**	**: 25**
Tutorial	**:**	**External Marks**	**: 75**
Credits	**: 3**	**External Examination**	**: 3 Hrs**

UNIT - I

Fundamentals and overview of Nano Sciences Nano Revolution of the XXX Century-Properties at Nano Scale(Optical, Electrical , Magnetic) , Theory , Definitions and Scaling – Metal Semi Conductor Nano Materials- Quantum Dots, wells and wires-Carbon Nano Tubes

UNIT - II

Nano Particles of Silicon Carbide, Alumina and Zirconia Applications of Silicon Carbide – Nano Materials Preparation- Sintering of Silicon Carbide -X-ray Diffraction Data-Electron Microscopy and Sintering of Nano Particles –Nano Particles of alumina and Zirconia preparation and Characterization – Wear Materials and Nano Composites.

UNIT - III

Properties of NanoMaterials Mechanical Properties –Strength of Nano Crystalline SiC – Preparation for Strength Measurements- Magnetic Properties Electrical Properties – Switching glasses with Nano Particles- Electronic Conduction with Nano Particles Optical Properties –Special Properties and Colored glasses

UNIT - IV

Synthesis of Nano Materials Top Down (Nanolithography CVD)- Bottom Up (Sol-get Processing ,Chemical Synthesis) – Wet Deposition Techniques- Molecular design and modeling

UNIT - V

Applications Solar Energy Conversion and Catalysis-Molecular Electronics – Printed Electronics-Nano Electronics-Liquid Crystalline Systems-Linear and Non Linear Electro and Electro Optical Properties- Applications in Displays and Other Devices-Advanced Organic materials for Data Storage –Photonics –Plasmonics-Nano Bio Technology and Nano Medicines.

TEXT BOOKS

1. Nano Materials - A.K.Bandyopadhyay New Age Publishers
2. Nano Structured Materials and Nano Technology-Hari Singh Nalwa

REFERENCES

Nano Essentials – T.Pradeep /TMH

LBRCE ★ EXAMINATION SECTION ★

HEAD
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