R18

B.Tech – M.E

SIDDHARTH INSTITUTE OF ENGINEERING &TECHNOLOGY:: PUTTUR
(AUTONOMOUS)
DEPARTMENT OF MECHANICAL ENGINEERING

I YEAR- I SEM

S No.	COURSE CODE	NAME OF THE SUBJECT	L	T	P/ Drg	C
1.	18HS0830	Mathematics-I	3	-	-	3
2.	18HS0850	Physics	3	1	-	4
3.	18CE0101	Engineering Mechanics	2	1	-	3
4.	18CS0501	Programming for problem solving	3	-	-	3
5.	18HS0852	Physics Lab	-	-	3	1.5
6.	18CS0503	Programming for problem solving Lab	-	-	3	1.5
7.	18ME0301	Workshop Practice Lab	-	-	4	2
		Induction Program (3 weeks)	-	-	-	-
Contact Periods / Week			**11**	**2**	**10**	**18**
			Total/Week 23			

I YEAR- II SEM

S No.	COURSE CODE	NAME OF THE SUBJECT	L	T	P/ Drg	C
1.	18HS0810	English	3	-	-	3
2.	18HS0831	Mathematics-II	3	1	-	4
3.	18HS0801	Chemistry	3	1	-	4
4.	18ME0302	Engineering Graphics& Design	1	-	4	3
5.	18ME0303	Materials Engineering	3	-	-	3
6.	18HS0811	English Lab	-	-	3	1.5
7.	18HS0802	Chemistry Lab	-	-	3	1.5
	Non-Credit Course					
8.	18HS0816	Indian Constitution	3	-	-	-
Contact Periods / Week			**16**	**2**	**10**	**20**
			Total/Week 28			

II YEAR- I SEM

S No.	COURSE CODE	NAME OF THE SUBJECT	L	T	P/ Drg	C
1.	18HS0835	Probability & Statistics	3	1	-	4
2.	18HS0803	Biology for Engineers	3	-	-	3
3.	18CE0151	Strength of Materials	3	-	-	3
4.	18ME0304	Kinematics of Machinery	3	-	-	3
5.	18CE0152	Fluid Mechanics & Fluid Machines	3	-	-	3
6.	18ME0305	Material Testing Lab	-	-	2	1
7.	18ME0306	Machine Drawing Lab	-	-	3	1.5
8.	18CE0153	Fluid Mechanics & Fluid Machines Lab	-	-	3	1.5
	Non-Credit Course					
9.	18HS0804	Environmental Sciences	3	-	-	-
Contact Periods / Week			**18**	**1**	**8**	**20**
			Total/Week 27			

II YEAR- II SEM

S No.	COURSE CODE	NAME OF THE SUBJECT	L	T	P/Drg	C
1	18ME0307	Non-Conventional Energy Resources	3	-	-	3
2	18EE0240	Basic Electrical & Electronics Engineering	3	-	-	3
3	18ME0308	Manufacturing Processes	3	-	-	3
4	18ME0309	Thermodynamics	3	1	-	4
5	18ME0310	Theory of Machines	3	-	-	3
6	18ME0311	Manufacturing Processes Lab	-	-	3	1.5
7	18EE0241	Basic Electrical & Electronics Engineering lab	-	-	3	1.5
Credit Course						
8	COE-I	Comprehensive Online Examination-I	-	-	-	1
Non-Credit Course						
9	18HS0817	Essence of Indian Traditional knowledge	3	-	-	-
Contact Periods / Week			**18**	**1**	**6**	**20**
			Total/Week 25			

III YEAR- I SEM

S No.	COURSE CODE	NAME OF THE SUBJECT	L	T	P/Drg	C
1.	18HS0860	Supply Chain Management	3	-	-	3
2.	18ME0312	CAD/CAM	3	-	-	3
3.	18ME0313	Design of Machine Elements-I	2	1	-	3
4.	18ME0314	Machine Tools	3	-	-	3
5.	18ME0315	Thermal Engineering	3	1	-	4
6.	18ME0316	Computer Aided Modeling Lab	-	-	2	1
7.	18ME0317	Machine Tools lab	-	-	3	1.5
8.	18ME0318	Thermal Engineering Lab	-	-	3	1.5
		Non-Credit Course				
9.	18HS0842	Aptitude Practices	2	-	-	-
Contact Periods / Week			**16**	**2**	**8**	
			Total/Week 26			**20**

III YEAR- II SEM

S No.	COURSE CODE	NAME OF THE SUBJECT	L	T	P/Drg	C
1.	18ME0319	Design of Machine Elements-II	2	1	-	3
2.	18ME0320	Heat & Mass Transfer	2	1	-	3
3.	18ME0321	Metrology & Measurements	3	-	-	3
Professional Elective Course (PEC) –I						
4.	18ME0330	Industrial Engineering &Management	3	-	-	3
	18ME0331	Production & Operations Management				
	18ME0332	Total Quality Management				
OPEN ELECTIVE –I						
5.	18CE0127	Elements of Road Traffic Safety	3	-	-	3
	18EE0234	Industrial Instrumentation				
	18EC0449	Introduction to IOT				
	18CS0517	Python Programming				
	18HS0814	Intellectual Property Rights				
6.	18ME0322	Heat Transfer Lab	-	-	2	1
7.	18ME0323	Metrology and Measurements Lab	-	-	2	1
8.	18ME0327	Internship (60 hours)	-	-	-	2
Credit Course						
9.	COE-II	Comprehensive Online Examination-II	-	-	-	1
Non -Credit Courses						
10.	18HS0859	English for Corporate Communication Skills Lab	-	-	2	-
Contact Periods / Week			**13**	**2**	**6**	
			Total/Week 21			**20**

IV YEAR- I SEM

S No.	Course Code	Name of the Subject	L	T	P/Drg	C
1	18ME0324	Operations Research	3	-	-	3
2	18ME0325	Automobile Engineering	3	-	-	3
3	**Professional Elective Course (PEC) – II**					
	18ME0334	Gas Dynamics and Jet Propulsion	3	-	-	3
	18ME0335	Turbo Machines				
	18ME0336	Refrigeration & Air Conditioning				
4	**Professional Elective Course (PEC) – III**					
	18ME0337	Mechatronics & Robotics	3	-	-	3
	18ME0338	Finite Element Analysis				
	18ME0339	Quality Control & Reliability Engineering				
	Professional Elective Course (PEC) – IV					
5	18ME0340	Advanced Welding processes	3	-	-	3
	18ME0341	Modern Machining Methods				
	18ME0342	Power Plant Engineering				
	Open Elective-II					
6	18CE0146	Project Planning and Control	3	-	-	3
	18EE0236	Solar Photovoltaic Systems				
	18EC0450	MATLAB Programming				
	18CS0544	Software Development & Testing				
	18HS0815	Entrepreneurship Development				
7	18ME0326	Computer Aided Analysis Lab	-	-	3	1.5
8	18ME0328	Robot Programming Lab	-	-	3	1.5
9	18ME0329	Project Phase-I	-	-	4	2
Contact Periods / Week			**18**	**-**	**10**	**23**
			Total/Week 28			

IV YEAR- II SEM

S.No	Course Code	Name of the Subject	L	T	P/Drg	C
1.	**MOOC-I**		3	-	-	3
2.	**MOOC-II**		3	-	-	3
3.	18ME0333	Project Phase-II	-	-	22	11
4.	18ME0353	Comprehensive Viva Voce	-	-	-	2
Contact Periods / Week			**6**	**-**	**22**	**19**
			Total/Week 28			

Note: L – Lecture hour ; T – Tutorial ; Drg – Drawing ; P-Practical

Year	1st year		2nd year		3rd year		4th year		Total
Semester	I sem	II sem	I sem	II sem	I sem	II sem	I sem	II sem	
Credits	18	20	20	20	20	20	23	19	160

Note: Total Number of credits = 160

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I B.Tech- I Sem

L	T	P	C
3	-	-	3

(18HS0830) MATHEMATICS-I

COURSE OBJECTIVES

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines. More precisely, the objectives are:

1. *To introduce the idea of applying differential and integral calculus to notions of curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions.*
2. *To introduce the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.*
3. *To develop the tool of power series and Fourier series for learning advanced Engineering Mathematics.*
4. *To familiarize the student with functions of several variables that is essential in most branches of engineering.*
5. *To develop the essential tool of matrices and linear algebra in a comprehensive manner.*

COURSE OUTCOMES

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

UNIT – I

Matrices:

Inverse and rank of a matrix; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigen values and Eigen vectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

UNIT – II

Calculus:

Evaluation of definite and improper integrals; Applications of definite integrals to evaluate surface areas and volumes of revolutions; Beta and Gamma functions and their properties. Rolle's Theorem, Mean value theorems (without proof) Taylor's and Maclaurin's theorems.

UNIT – III

Multivariable Calculus: *(Differentiation)*

Limit, continuity and partial derivatives, total derivative; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, directional derivatives, curl and divergence.

UNIT – IV

Sequences and Series

Convergence of sequence and series, tests for convergence (Geometric test, P- test, limit comparison test, D' Alember ratio test, Cauchy's nth root test); Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

UNIT-V

Fourier Series:

Determination of Fourier coefficients- Fourier series- Even and odd functions, Fourier series in an arbitrary interval, Periodic function, Half range sine and cosine series.

TEXT BOOKS

1. B.S. Grewal, *Higher Engineering Mathematics, Khanna,publishers-42nd Edition, 2012*
2. T.K.V. Iyengar, *Engineering Mathematics Volume-I*, S. Chand publication-12thEdition, 2010
3. V. Venkateswara Rao, *A Text book of B.Sc. mathematics volume-II*, S. Chand Publications, 2011

REFERENCES

1. Ramana B.V., *Higher Engineering Mathematics*, Tata McGraw Hill New Delhi, 11thReprint, 2010.
2. E. Rukmangadachari & E. Keshava Reddy, *Engineering Mathematics, volume-I&II*, Pearson Publishers. 2001
3. D. Poole, *Linear Algebra: A Modern Introduction*, 2nd Edition, Brooks/Cole, 2005.
4. N.P. Bali and Manish Goyal, *A text book of Engineering Mathematics*, Laxmi Publications, Reprint, 2008.
5. Bhavanari Satyanarayana, T.V. Pradeepkumar & D. Srinivasulu, *Linear Algebra & Vector Calculus*, Studera Press, New Delhi. 2008

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I B.Tech- I Sem

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

(18HS0850) PHYSICS

COURSE OBJECTIVES

The objectives of this course to

1. *Understand the properties of electromagnetic waves.*
2. *Recognize the basic concepts related Maxwell equations and properties of magnetic materials.*
3. *Identify various basic terms related to Waves, Optics and Acoustics.*
4. *Know the basic concepts related properties of Lasers..*
5. *Understand the fundamentals Nano materials.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Explain properties of electromagnetic waves.*
2. *Recognize some of the basic concepts related Maxwell equations and properties of magnetic materials.*
3. *Distinguish various basic terms related to Waves, Optics and Acoustics.*
4. *Understand Some of the basic concepts related properties of Laser.*
5. *Identify the importance and applications of Nanotechnology.*

UNIT –I

Electromagnetism and Magnetic Properties of Materials:

Laws of electrostatics, electric current and the continuity equation, laws of magnetism. Ampere's, Bio- Savart, Faraday's laws and Lenz's law – electromagnetic breaking and its applications - Maxwell's equations.

Magnetization - permeability and susceptibility - classification of magnetic materials, ferromagnetism - magnetic domains and hysteresis - applications.

UNIT –II

Electromagnetic Waves:

The wave equation- plane electromagnetic waves in vacuum their transverse nature and polarization – relation between electric and magnetic fields of an electromagnetic wave – energy carried by an electromagnetic wave and examples – Momentum carried by electromagnetic waves and resultant pressure – Reflection and transmission of electromagnetic waves from a non-conducting medium- vacuum interface for normal incidence.

UNIT – III

Waves, Optics & Acoustics:

Mechanical and electrical simple harmonic oscillators - damped harmonic oscillator - forced mechanical and electrical oscillators.

Interference in thin films by reflection - Newton's rings - Farunhofer diffraction from a single slit - Diffraction gratings and characteristics of grating spectrum.

Reverberation- Reverberation time (qualitative treatment) - Factors affecting acoustics of buildings and their remedies.

UNIT – IV

Lasers:

Properties of laser beams: mono-chromaticity, coherence, directionality and brightness Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne), solid-state lasers (Neodymium), applications of lasers in science, engineering and medicine.

UNIT-V

Physics of Nano Materials.

Introduction, significance of nano scale – surface area and quantum confinement- Quantum dot, quantum well -Quantum wire -Synthesis of nanomaterial- Top Down Process- Ball Milling ; Bottom Up Process: Sol-Gel method– CNT-Properties of Graphene- Applications.

TEXT BOOKS

1. H. J. Pain, *The physics of vibrations and waves*, Wiley, 2006.
2. E. Hecht, *Optics*, Pearson Education, 2008.

REFERENCES

1. O. Svelto, *Principles of Lasers*, Springer Science & Business Media, 2010.
2. Halliday and Resnick, *Physics*, 2009
3. Electricity, W .Saslow *Magnetism and light*, 2008

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I B.Tech- I Sem

L	T	P	C
2	1	-	**3**

(18CE0101) ENGINEERING MECHANICS

COURSE OBJECTIVES

The objectives of this course to

1. *Learn about forces and force systems and their applications.*
2. *Know about friction and to use the concept of Friction.*
3. *Understand method of finding centroid of different objects using Mathematical formula.*
4. *Learn how to find Moments of Inertia of different objects using Mathematical formula.*
5. *Identify the importance of residual trusses in joints and sections*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Construct free body diagrams and develop appropriate equilibrium equations.*
2. *Understand the concepts of friction and to apply in real life problems.*
3. *Determine the centroid for composite sections.*
4. *Calculate the Moment of Inertia for composite sections.*
5. *Analyse the deficient and residual trusses in joints*

UNIT-I

Forces & Force Systems: Fundamental Principles – Resolution and Composition of Forces and Equilibrium of Particles – Lami's Theorem - Principle of Transmissibility – Principles of Continuum - Types of Force Systems – Resultant of Coplanar, Concurrent and Non-Concurrent Force Systems - Varignon's Theorem - Equilibrium of Coplanar Force Systems – Types of Beams and Supports – Support Reactions.

UNIT-II

Friction: Types of Friction– Laws of Friction–Limiting Friction–Cone of Limiting Friction - Ladder Friction - Wedge, Screw jack and differential Screw Jack

UNIT-III

Centroid: Centroids of Simple Figures (From Basic Principles) – Centroids of Composite Figures
Centre of Gravity: Centre of Gravity of Simple Body -Centre of Gravity of Composite Bodies- Pappus Theorem

UNIT-IV

Moment of Inertia: Definition – Parallel Axis Theorem and Perpendicular Axis Theorem – Polar Moment of Inertia – Radius of Gyration – Moment of Inertia of Basic Shapes - Composite Sections - Simple Solids.

UNIT-V

Analysis of Perfect Trusses: Types of Trusses – Perfect, Deficient and Redundant Trusses - Cantilever Trusses and Simply Supported Trusses – Analysis of Trusses using Method of Joints and Methods of Sections.

TEXT BOOKS

1. Bhavikatti S S, *A Textbook of Engineering Mechanics*, New Age International, 3rd Edition, 2016.
2. Dr. R. K. Bansal, *Engineering Mechanics*, Laxmi Publications, 4th Edition, 2011.
3. K. Vijaya Kumar Reddy, J. Suresh Kumar, *Singer's Engineering Mechanics: Statics and Dynamics*, B.S. Publications, 3rd Edition, 2011

REFERENCES

1. D.S. Kumar, *Engineering Mechanics*, S.K. KATARIA & SONS 3rd Edition,2008
2. J L Meriam, L G Kraige *Engineering Mechanics: Statics*, Wiley India Pvt. Ltd, *6th Edition*,, 2001.

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I B.Tech- I Sem

L	T	P	C
3	-	-	3

(18CS0501) PROGRAMMING FOR PROBLEM SOLVING

COURSE OBJECTIVES

The objectives of this course is to

1. *Understand the core aspects of computer problem solving techniques*
2. *Understand the programming language constructs*
3. *Understand the programming paradigms*

COURSE OUTCOMES

On successful completion of this course the students will be able to

1. *Design the flowchart and algorithm for real world problems*
2. *Learn and understand new programming languages*
3. *Construct modular and readable programs*
4. *Write C programs for real world problems using simple and compound data types*
5. *Identify the importance of points, arrays, functions and strings*

UNIT I

Overview of Computers and C-Programming:

Description of Computer Hardware & Software.

Introduction to C:overview of C, executing a 'c' program, c-character set, constants, variables, data types, declaration of variables, assigning values to variables, managing input & output operations, operators and expressions, basics of algorithm and flow chart

UNIT II

Decision & Loop control Statements: Introduction, If Statement, If-else Statement, Nested- If-else Statement, Else if Ladder, Switch case – break – continue – go to Statement ,for loop, nested for loop, while loop, do-while, do-while statement with while loop

UNIT III

Arrays: Introduction, one-dimensional (1D)-Arrays, declaration and initialization of one-dimensional (1D)-Arrays, Two- dimensional (2D)-Arrays, initialization of Two-dimensional (2D)-Arrays, Multi-dimensional Arrays

Functions: Introduction, need for user-defined functions, a multi-function program, elements of user-defined functions, definition of functions, return values and types, category of functions, recursion, scope and life time of variables, preprocessor commands: #define, #include, multi file programs

UNIT IV

Pointers: Introduction, understanding pointers, accessing address of a variable, declaring and initialization of pointer variables, accessing variable through pointers, chain of pointers, pointer expressions, pointer increment and scale factor, pointers and arrays, passing arrays to functions, array of pointers, pointers as function arguments, functions returning pointers.

Strings: Introduction, declaring and initializing string variables, reading and writing strings, arithmetic operations on characters, putting strings together, comparison of two strings, string handling functions, table of strings (array of strings)

UNIT V

Structures: Introduction , defining a structure , declaring structure variables ,accessing structure members, structure initialization, copying and comparing structure variables, operations on individual members , arrays of structures ,arrays within structures, structures within structures, structures and functions, unions, typed ef, enum

File Management in C: Introduction, Types of Files, Defining and Opening a File, Closing a File, Input / Output Operations on Files, Error handling during IO Operations, Random access to files, Command line arguments.

TEXT BOOKS

1. Ashok Kamthane, *C and Data Structures* –Pearson education, 2008
2. E Balagurusamy , *Programming in C and Data Structures* – Mc GrawHill, 2007
3. George S. Tselikis- Nikolaos D. Tselikas , *C from Theory to Practice* - CRC Press, 2010

REFERENCES

1. Dr. P. Chenna Reddy , *Computer Fundamentals and C Programming* -, ISBN: 9789351045885, Publisher: Pothi.com, 1997
2. Pradip Dey, Manas Ghosh, *Programming in C*, Second Edition –Oxford University Press, 2002
3. R S Bichkar, *Programming with C*, University Press, 2001
4. J.R.Hanly, Ashok N. Kamthane and A.Ananda Rao, *Programming in C and Data Structures*, Pearson Education, 2008

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I B.Tech- I Sem

L	T	P	C
-	-	3	**1.5**

(18HS0852) PHYSICS LAB

COURSE OBJECTIVES

The objectives of this course is to

Physics practical course is meant for making the students to gain practical knowledge to correlate with the theoretical studies. It covers experiments on principle of Mechanics and optics, measurement of magnetic field and studying resonance using LCR circuit.

1. *To explore the application of Interference and Diffraction by doing concerned experiments.*
2. *Elucidate the concepts of Physics through involvement in the experiment by applying theoretical knowledge.*
3. *To understand the concept of energy gap, B-H curve and resonance phenomena in LCR circuits.*
4. *Develop an ability to apply the knowledge of physics experiments in the later studies.*

Suggested list of experiments from the following: (Perform any EIGHT experiments from the following)

1. Determination of wavelengths of various colors of Mercury spectrum using Diffraction Grating – Normal Incidence method.
2. Determination of Dispersive power of prism.
3. Rigidity Modulus – Torsional Pendulum
4. Study of Resonance effect in Series and Parallel LCR circuit.
5. Determination of thickness of thin object by wedge method.
6. Determination of radius of curvature of Plano convex lens – Newton's Rings.
7. Determination of wavelength of a given laser source by using diffraction grating.
8. Determination of particle size using laser source.
9. Determination of energy gap of a semiconductor using p – n junction diode.
10. B- H curve.
11. Magnetic field along the axis of current carrying coil – Stewart & Gee's Method.
12. Determination of frequency of tuning fork - Melde's Apparatus.
13. Determination of spring constant – Coupled Oscillator.
14. Study of Characteristics of Solar Cell.
15. Determination of Numerical Aperture of an Optical fiber.

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L	T	P	C
-	-	3	**1.5**

(18CS0503) PROGRAMMING FOR PROBLEM SOLVING LAB

COURSE OBJECTIVES

The objectives of this course is to

1. *Make the student learn C Programming language.*
2. *Solve problems, implement those using C & C++ programming languages.*
3. *Identify and apply the suitable data structure for the given real world problem.*

COURSE OUTCOMES

On successful completion of this course the students will be able to

1. *Apply problem solving techniques of C to find solution.*
2. *Use C language features effectively to implement solutions.*
3. *Use C++ language features effectively to solve problems.*
4. *Identify and develop apt searching and sorting technique for a given problem.*
5. *Identity, design and develop the appropriate data structure for a given problem or application.*

Experiments List:

1. a) Acquainting students to "C" programming environment and DOS commands
   b) Calculate sum of three numbers using C-program
2. a) Swap(exchange) values of two integer variables using C-program
   b) Read an integer, a character and a float values through keyboard and display
   c) Check operators precedence and associativity using C-program
   d) Write a c-program using all basic data types of C language
3. a) Read 3 integer values through keyboard and display largest among them
   b) Read marks of 5 subjects obtained by a student through keyboard and display "fail" or "pass" message on console
   c) Using switch () statement implement arithmetic operations
4. a) Check whether entered number is prime number
   b) Display factorial of entered number
   c) Display all multiples of an entered number up to given value(n)
5. a) Generate Fibonacci series up to entered number(n)
   b) Find out sum of the digits of a number
6. a) Find the binary equivalent of entered decimal number
7. Generation multiplication table of entered number (n)

8. a) Calculate sum of two integer matrices
   b) Calculate product of two integer matrices
9. a) Create your header file by including 2 user(your) defined functions and include them in a c-program student
   b) Find out factorial of a number using recursive function
   c) Find square of an entered number using "call by address (reference)" technique
   d) A program that tells us purpose of few predefined functions in "math.h" header file]
10. a) Check whether entered string is palindrome
    b) Write a program to sort the entered set of strings using structure concept
11. a) Count number of vowels, consonants, digits, white spaces and special characters in entered string(a line of text)
    b) Swap(exchange) values of two integer variables using pointers
12. a) For 3 students with 3 subjects, calculate total marks and grade obtained by each
    b) Read data from a file (text) and display it on the monitor
13. a) Copy contents of one file(text) to other created file
    b) Merge contents of two files (text) and store it in another created file

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I B.Tech- I Sem

L	T	P	C
-	-	4	**2**

(18ME0301) WORKSHOP PRACTICE LAB

Part-A ENGINEERING WORKSHOP LAB

COURSE OBJECTIVES

The objectives of this course is to

1. *The course provides hands-on training in the trades of Carpentry, Fitting, House-wiring, Tin Smithy, and Foundry. Overview of metal cutting processes, plumbing and welding is provided through live demonstrations.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Utilize workshop tools for engineering practice.*
2. *Employ skills for the production a component for real time applications.*
3. *Appreciate the hard work and intuitive knowledge of the manual workers.*
4. *Recognize the importance of workshop in daily life*

List of Experiments

1. Trades For Exercises

a. Carpentry shop: Two joints (exercises) involving tenon and mortising, groove and tongue: Making middle lap T joint, Cross lap joint, Mortise and tenon T joint, Bridle T joint from soft wood stock.

b. Fitting shop: Two joints (exercises) from: Square joint, V joint, Half round joint or Dovetail joint out of 100 x 50 x 5 mm M.S. stock.

c. Sheet metal shop: Two jobs (exercises) from: Tray, Cylinder, Hopper or Funnel from out of 22 or 20 gauge G.I. sheet.

d. House-wiring: Two jobs (exercises) from: Wiring for ceiling rose and two lamps (bulbs)with independent switch, two way switch, controls with or without looping, wiring for stair case lamp, wiring for water pump with single phase starter.

e. Foundry: Preparation of two moulds (exercises): for a single pattern and a double pattern.

f. Welding: Preparation of two welds (exercises): Single V butt joint, Lap joint, Double V butt joint or T fillet joint.

2. Trades for Demonstration:

a. Plumbing

b. Machine Shop

c. Metal Cutting

Apart from the above the shop rooms should display charts, layouts, figures, circuits, hand tools, hand machines, models of jobs, materials with names such as different woods, wood faults, Plastics, steels, meters, gauges, equipment, CD or DVD displays, First aid, shop safety etc. (though they may not be used for the exercises but they give valuable information to the student). In the class work or in the examination knowledge of all shop practices may be stressed upon rather than skill acquired in making the job.

TEXT BOOKS/ REFERENCES:

1. Ramesh Babu, *Engineering Work shop practice for JNTU*, VRB Publishers Pvt. Ltd., 2009
2. P. Kannaiah & K.L. Narayana , *Work shop Manual*, SciTech Publishers, 2010
3. GHF Nayler, *Dictionary of Mechanical Engineering*, Jaico Publishing House, 2010

Part B - IT WORKSHOP

COURSE OBJECTIVES

The objectives of this course is to

1. *Provide students with hands-on experience in basic hardware, productivity tools and basic operating system installations.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Identify the basic computer peripherals.*
2. *Gain sufficient knowledge on assembling and disassembling a PC.*
3. *Learn the installation procedure of Windows and Linux OS.*
4. *Acquire knowledge on basic networking infrastructure.*
5. *Learn productivity tools like Word, Excel and Power point.*
6. *Acquire knowledge on basics of internet and worldwide web.*

Task 1:

Identification of the peripherals of a computer: To prepare a report containing the block diagram of the CPU along with the configuration of each peripheral and its functions. Description of various I/O Devices

Task 2:

A practice on disassembling the components of a PC and assembling them.

Task 3:

1. Basic DOS commands, Installation of MS windows.
2. Basic Linux Commands, Installation of Linux.

Task 4:

Hardware Troubleshooting (Demonstration): Identification of a problem and fixing the solution (improper assembly or defective peripherals). Software Troubleshooting (Demonstration): Identification of a problem and fixing the PC for any software issues

Productivity tools

Task 5:

1. **MS Word Orientation:** Accessing, overview of toolbars, saving files, Using help and resources, rulers, formatting ,Drop Cap , Applying Text effects, Using Character Spacing, using templates, Borders and Colors, Inserting Header and Footer, Using Date and Time option, security features in word, converting documents while saving
2. **Presentations:** Creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show. Students should submit a user manual of the Presentation tool considered.
3. **Spread sheet:** Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet application considered.

Task 6:

Networking: Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimpling activity, logical configuration etc should be done by the student. The entire process has to be documented.

REFERENCES:

1. Peter Norton, *Introduction to Computers*, McGraw Hill, 2001
2. oan Lambert, Joyce Cox, *MOS study guide for word, Excel, Power point & amp; Outlook Exams*, J PHI. 2008
3. *Introduction to Information Technology*, ITL Education Solutions limited, Pearson Education.2009
4. Rusen, *Networking your computers and devices*, , PHI, 2009
5. Bigelows , *Trouble shooting, Maintaining & amp; Repairing PCs*, , TMH, 2010

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(18HS0810) ENGLISH

COURSE OBJECTIVES

The objectives of this course is to

1. *Develop interest in reading English Literature for language learning.*
2. *Improve knowledge and understanding of Grammar.*
3. *Enhance the ability for making use of grammar in writing English.*
4. *Enrich communication skills among the students.*
5. *Impart LSRW skills and inculcate the habit of learning.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Understand the rules of English grammar and their usage in writing English.*
2. *Use LSRW skills through the prescribed text and develop their ability to communicate effectively.*
3. *Get the mastery of language to express ideas, views, feelings and experience.*
4. *Communicate well among themselves.*
5. *Inculcate values and ideal characteristic qualities in themselves.*

UNIT-I

Reading:

1. *All the World's a Stage* by William Shakespeare. (Act-II, Scene-VII).
2. *After Twenty Years* by O. Henry.

Writing: Nature and Style of Sensible Writing: Describing & Defining.

Speaking: Oral Communication (involves interactive practice sessions) Self -introduction and introducing a friend.

Listening: Listening activity (Present tense).

Vocabulary: The concept of word formation & root words from foreign languages.

Grammar: Subject – Verb Agreement. Sentence Structures & use of phrases and clauses in sentences. Identify in common errors in noun, pronoun and adjectives.

UNIT-II

Reading:

1. *I Have a Dream* Martin Luther King sjr.
2. *Knowledge and Wisdom* by Bertrand Russell.

Writing: Importance of proper punctuation and creating coherence- Simple sentences.

Speaking: Expressing apology.

Listening: Listening activity. (Past tense)

Vocabulary: Prefixes and Suffixes.

Grammar: Identifying common errors in Articles, Modifiers and degrees of comparison.

UNIT-III

Reading:

1) Nelson Mandela (Biography)
2) "The Happy Prince" by OscarWilde.

Writing: Paragraph writing – letter writing.

Speaking: Situational dialogues.

Listening: Listening activity. (Future tense)

Vocabulary: Synonyms and Antonyms.

Grammar: Identifying common errors in Prepositions and Link words and complex sentences.

UNIT-IV

Reading:

1. *Where the Mind is without Fear* by Rabindra Nath Tagore.
2. Cause - Effect and Control Measures of Pollution (Air, Water, Noise) and Nuclear Hazards.

Writing: Essay writing - Organizing principles of essay writing - Introduction and Conclusion.

Speaking: Public speaking dynamics.

Listening: Listening activity. (Active voice and passive voice)

Vocabulary: Abbreviations and Acronyms.

Grammar: Identifying common errors in redundancies and compound sentences.

UNIT-V

Reading:

1. *The Road not Taken* by Robert Frost.
2. *An Astrologer's Day* by R K Narayan.

Writing: Techniques for writing precisely.

Speaking: Interviews and formal presentations.

Listening: speeches of A P J Abdul Kalam, Steve Jobs and so on.

Vocabulary: One word substitutes.

Grammar: Identifying common errors in clichés.

TEXT BOOKS

1. Michael Swan ,*Practical English Usage.*, OUP. 1995.
2. F.T. Wood , *Remedial English Gramma.*, Macmillan. 2007.
3. William Zinsser ,*On Writing Well.*, Harper Resource Book, 2008
4. Liz Hamp-Lyons and Ben Heasly, *Study Writing.*. Cambridge University Press, 2006.

REFERENCES

1. *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press, 2011.
3. *Exercises in Spoken English*. Parts. I-III. CIEFL, Hyd. Oxford University Press, 2005.
4. Oscar Wilde, Create Independence Publisher, Kindle Edition, 2017.
5. The Complete Works of William Shakespeare, Kindle Edition, 2017.
6. G. P. Editors, the Complete Works of William Shakespeare, Global Classic, 2018.
7. Robert Frost, Robert Frost Collection, Wider Publication, 2011.

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(18HS0831) MATHEMATICS II

COURSE OBJECTIVES

The objective of this course is to familiarize the prospective engineers with techniques in Multivariate integration, ordinary and partial differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines. More precisely, the objectives are:

1. *To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.*
2. *To introduce effective mathematical tools for the solutions of differential equations that model physical processes.*
3. *To introduce the tools of differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.*

COURSE OUTCOMES

The outcome of this course is to familiarize the prospective engineers with techniques in calculus, multivariable calculus and complex analysis. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of Mathematics and applications that they would find useful in their disciplines.

UNIT-I

First order ordinary differential equations:

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

UNIT-II

Ordinary differential equations of higher orders:

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

UNIT-III

Multivariable Calculus (Integration):

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Triple integrals (Cartesian), orthogonal curvilinear coordinates.

UNIT-IV

Complex Variable – Differentiation :

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

UNIT-V

Complex Variable – Integration:

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine.

TEXT BOOKS

1. *Higher Engineering Mathematics*, B.S. Grewal, Khanna publishers, 2001
2. *Engineering Mathematics Volume-I &III* by T.K.V. Iyengar, S. Chand publication, 2007
3. *Higher Engineering Mathematics*, Ramana B.V., Tata McGraw Hill New Delhi, 11thReprint, 2010.

REFERENCES

1. *Engineering Mathematics, volume-I&III*, E. Rukmangadachari & E.Keshava Reddy Pearson Publishers, 2009
2. *Engineering Mathematics-I & III*, T.K.V. Iyengar S. Chand Publications, 2011
3. *Linear Algebra: A Modern Introduction*, D. Poole, 2nd Edition, Brooks/Cole, 2005.
4. *A text book of Engineering Mathematics*, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2008.

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(18HS0801) CHEMISTRY

COURSE OBJECTIVES

The objectives of this course is to

1. *Developed in this course will aid in quantification of several concepts in chemistry that have been introduce at the 10+2 levels in schools.*
2. *Technology is being increasingly based on the electronic, atomic and molecular level modifications.*
3. *Quantum theory is more than 100 years old and to understand phenomena at Nanometer levels, one has to base the description of all chemical processes at molecular levels.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.*
2. *Able to design the flowchart and algorithm for real world problems*
3. *Able to learn and understand new programming languages*

UNIT-I

Atomic, Molecular Structure and Periodic Properties

Schrodinger wave equation, Molecular orbital's of diatomic molecules. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.

Effective Nuclear charge, variations of s, p, d and f orbital energies of atoms in the periodic table, atomic and ionic sizes, oxidation states, hard soft acids and bases, molecular geometries.

UNIT-II

Uses of Free Energy and Chemical Equilibria

Thermodynamic functions: Energy Entropy and free energy, Cell potentials, Nernest equations and Its Applications. Acid base Oxidation, reduction and Solubility Equilibrium.

Corrosion: Types of Corrosion, Factors Influencing the rate of Corrosion, Prevention of Corrosion (Sacrificial anodic protection, Impressed Cathodic Protection), Anodic and Cathodic Inhibitors, Electro plating (Copper, Nickel, Chromium) and Electroless Plating.

UNIT-III

Water Technology

Hardness of water and its units, Estimation of Hardness by EDTA method. Boiler Troubles: Scale & Sludge, Priming and Foaming and Boiler corrosion. Municipal Solid waste water Treatment. Break point chlorination, Water softening methods (Lime-Soda, Zeolite, Ion- Exchange resins). Demineralization of Brackish Water: Reverse Osmosis and Electro Dialysis.

UNIT-IV

Organic Reactions and Organic Polymers

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, Synthesis of a commonly used drug molecules (Paracetamol, Penicillin, Prodrugs - Asprin, Sulfa drugs)

Organic polymers types (Thermosetting and Thermoplastics), Preparation, Properties and Engineering Applications of PVC, Teflon, Nylon6,6, Bakelite), Moulding Process and its uses, Conducting polymers (Polyacetylene, Polyaniline).

UNIT-V

Spectroscopic Techniques and Applications

Principles, selection rules and applications of absorption (UV/Visible, Atomic Absorption, Infrared) and Emission spectroscopy (Flame photometry and Fluorescence and its applications in medicine. Advanced Instrumental Techniques and their Significance: XRD, Scanning Electron microscope (SEM) and Transmission electron microscopy (TEM).

TEXT BOOKS

1. *University chemistry*, by B. H. Mahan, 2001
2. *Chemistry: Principles and Applications*, by M. J. Sienko and R. A. Plane, 2005
3. *Fundamentals of Molecular Spectroscopy*, by C. N. Banwell, 2010

REFERENCES:

1. *Engineering Chemistry (NPTEL Web-book)*, by B. L. Tembe, Kamaluddin and M. S. Krishnan, 2009
2. *Physical Chemistry*, by P. W. Atkins, 2011
3. *Organic Chemistry: Structure and Function* by K. P. C. Volhardt and N. E. Schore, 5th Edition, 2012

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(18ME0302) ENGINEERING GRAPHICS & DESIGN

COURSE OBJECTIVES

The objectives of this course is

1. *To familiarize the students in basic concept of conic sections, projections and Development of Objects.*
2. *To develop the imagination and drafting skills of students.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Frame ideas based on the conceptual modeling and design*
2. *Provide good understanding of the methods involved in preparing various views in Engineering drawings*
3. *Can prepare 2D and 3D diagrams of various objects*

UNIT-I

Introduction to Engineering Drawing - Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections, Cycloids and Involutes.

UNIT-II

Projections of Points - Principles of Orthographic Projections-Conventions - Projections of Points, Traces
Projections of straight lines - Inclined to both the planes (Trapezoidal Method & Rotating line method) - simple problems only, Traces

UNIT-III

Projections of planes – Surface inclined to both reference planes
Projections of Solids- Introduction– Projections of right regular solids-Prisms, Pyramids in different positions. (Inclined to one plane only).

UNIT-IV

Sections of solids - Sectional Views of Right regular Solids - Prisms, Pyramids.
Development of surfaces - Development of surfaces of Right Regular Solids - Prisms, Pyramids.

UNIT-V

Orthographic Projections - Principles of Orthographic projection, Conversion of objects from 3D to 2D

Isometric Projections - Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids, Conversion of 2D to 3D.

Auto CAD (for Practice only not for External Exam)

Introduction to CAD, Applications, commands, Tool bar, modeling of Simple parts, isometric problems.

TEXT BOOKS

1. *Engineering Drawing*, N.D.Bhatt, Charotar Publishers,2005.
2. *A text Book of Engineering Drawing*, K.L.Narayana, Kannaiah, Scitech Publishers, 2010
3. *Engineering Graphics with using AutoCAD,2007*. Jeyapoovan.T, Vikas Publishing House, 2007

REFERENCES

1. *Fundamentals of Engineering Drawing*, Warren J.Luzadder and Jon. M.Duff Prentice Hall of India Pvt., Ltd., Eleventh Edition, 2001.
2. *Engineering Graphics*, Bhattacharyya, S.C.Bera, I.K .International Pvt Ltd. 2009.
3. *A text Book of Engineering Drawing and Graphic*, K.Venugopal New Age Publishin New Delhi, 2008.

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(18ME0303) MATERIALS ENGINEERING

COURSE OBJECTIVES

The objectives of this course is to

1. *To understand the structure, properties, testing methods and heat treatment methods of metals and non-metals so as to gain knowledge in the selection of suitable materials for various engineering applications.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Describe fundamental scientific (chemistry, physics) and engineering principles (material science) in materials processes and material systems.*
2. *Students will get knowledge on bonds of solids and knowing the crystallization of metals*
3. *Students should be able to understand the equilibrium diagrams and their usage in the production processes.*

UNIT-I

Structure of Metals: Classification of Materials - Engineering properties of Materials, Bonds in Solids – Metallic bond - 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, Types of solid solutions, Hume Rothery's rules, Intermediate alloy phases, and Electron compounds, BIS.

UNIT-II

Equilibrium of Diagrams - Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, Equilibrium cooling and heating of alloys, Lever rule, Coring miscibility gaps, Eutectic systems, Congruent melting intermediate phases, Peritectic reaction. **Transformations** in the solid state – Allotropy, Eutectoid, Peritectoid reactions, Phase rule, Relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, and Fe-Fe_3C.

UNIT-III

Cast Irons and Steels: Structure and properties of White Cast iron, Malleable Cast iron, Grey cast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, Structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, Tool and die steels, Applications.

Non-Ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminum and its alloys, Titanium and its alloys.

UNIT-IV

Heat Treatment of Alloys: Effect of alloying elements on Iron – Iron carbon system, Annealing, Normalizing, Hardening, TTT diagrams, Tempering, Hardenability, Surface hardening methods, Age hardening treatment, Cryogenic treatment of alloys.

Fracture Mechanism: Mechanical properties of materials& fracture. Introduction to Non Destructive Testing (NDT).

UNIT-V

Ceramic Materials: Crystalline ceramics, Glasses, Cermet, Polymeric Materials

Introduction to Composite Materials: Classification of composites, various methods of component manufacture of composites, Particle – Reinforced materials, Fiber reinforced materials, Polymer matrix composites, Metal – Matrix composites and Carbon – Carbon composites-Applications.

TEXT BOOKS

1. *Introduction to Physical Metallurgy*, Sidney H. Avner, US, Tata McGraw-Hill, 2nd Edition, 2007.
2. *Engineering Materials and Metallurgy*, R.K.Rajput, S.Chand, 1st Editon, 2008.
3. *A Text Book of Material Science and Metallurgy for Engineers*, Dr.Kodgiri And Susheel Kodgiri Everest Publishing House, 37th Edition, 2007

REFERENCES

1. *Mechanical Metallurgy*, Dieter, G. E., McGraw Hill, Singapore, 2012.
2. *Material Science and Metallurgy*, Kodgire, V.D, Everest Publishing House, 12th Edition 2002.

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(18HS0811) ENGLISH LAB

COURSE OBJECTIVES

The objectives of this course is

To get the job students dream of today largely depends on the way they communicate. Due to globalization, civilization and fast growing technologies, communication has become a very important factor. Good communication skills increase the possibilities of getting good jobs. To meet the requirement of corporate word one has to be capable of expressing oneself.

1. *To provide Computer Assisted Language Learning facility for the students on self-instructional method for improving language.*
2. *To improve the correct articulation as English is international language.*
3. *To enhance the communication skills with a variety of activities and practice sessions.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *To recognize sounds of English language with different classifications.*
2. *To know phonetic transcription and phonemic symbols of English language.*
3. *To understand international accent and utilize the same in their daily conversation.*
4. *To crease confidence for public speaking, for facing interviews, for making effective oral presentations, for having discussions, and for delivering impromptu speeches.*

UNIT -I

a) Importance of Phonetics – Introduction, organs of speech, classification of sounds, and Phonetic transcriptions.

UNIT-II

a) Syllable, Syllabification, Word stress, Stress Rules and Intonation.
b) Intonation (Falling, Raising, and fall-raise) - Pitch and Rhythm.
c) Influence of mother tongue (MTI) - Common Indian Variants in pronunciation.
d) Difference between British and American Pronunciation

UNIT- III

a) Vocabulary building.
b) Functional English; Telephone skills; Giving Directions; Situational dialogues; Role play.
c) JAM, Oral presentation-Prepared and extempore and PPT presentation.

UNIT- IV

a) Describing people, places, things and situations- Body language–- listening some

UNIT- V

a) Preparation of resume (C.V) & Cover Letter.
b) Interview Skills - mock interviews.
c) Group Discussion, Debate and Dress code.

Minimum requirement for ELCS LAB

1. Computer Assisted Language Learning (CALL) Lab: The Computer Aided Language Lab for 60 Students with 60 systems one Master Console, LAN facility and English Language Software for self-study by learners.
2. The Communication Skills Lab with movable chairs and audio visual aids with a P. A. system, Projector, a Digital stereo audio & video system and Camcorder etc.
   System Requirement (Hardware component):
   Computer network with: LAN with minimum 60 multimedia systems with the following.
   Specifications:
   i) P- IV Processor
      a) Speed 2.8 GHZ
      b) RAM – 512 MB Minimum
      c) Hard Disk – 80 GB
   ii) Headphones of High quality.

Suggested Software

1. Clarity pronunciation power--- Part 1(sky pronunciation)
2. Clarity pronunciation power--- Part 2
3. K-Van Advanced Communication Skills.
4. Walden Info tech Software.

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(18HS0802) CHEMISTRY LAB

List of Experiments

1. Estimation of copper by EDTA method
2. Determination of chloride content of water
3. Determination of acidity of water sample.
4. Determination of alkalinity of water sample
5. Potentiometric determination of Fe^{2+} by potassium permanganate.
6. Determination of Viscosity of an oil by Redwood Viscometer
7. Determination of dissolved oxygen in a water sample by Winkler's method
8. Conductometric titrations of strong acid against strong base.
9. Chemical analysis of a salt
10. Synthesis of a polymer/drug

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(18HS0816) INDIAN CONSTITUTION

COURSE OBJECTIVES

The objectives of this course is to

1. *Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.*
2. *To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*
3. *To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.*

COURSE OUTCOMES

On successful completion of the course, the students will be able

1. *Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*
2. *Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.*
3. *Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.*
4. *Discuss the passage of the Hindu Code Bill of 1956.*

UNIT-I

- Meaning of the Constitution Law

UNIT-II

- Historical Perspective of the Constitution of India
- Salient features and characteristics of the Constitution of India

UNIT-III

- Scheme of the fundamental rights
- The scheme of the Fundamental Duties and its legal status
- The Directive Principles of State Policy – Its importance and implementation
- Federal structure and distribution of legislative and financial powers between the Union and the States

UNIT-IV

- Parliamentary Form of Government in India – The constitution powers and status of the President of India.
- Amendment of the Constitutional Powers and Procedure.
- The historical perspectives of the constitutional amendments in India.
- Emergency Provisions : National Emergency, President Rule, Financial Emergency

UNIT-V

- Local Self Government – Constitutional Scheme in India.
- Scheme of the Fundamental Right to Equality.
- Scheme of the Fundamental Right to certain Freedom under Article 19
- Scope of the Right to Life and Personal Liberty under Article 21

TEXT BOOKS

1. *The Constitution of India*, 1950 (Bare Act), Government Publication.

2. *Framing of Indian Constitution*, Dr. S. N. Busi, Dr. B. R. Ambedkar 1st Edition, 2015

REFERENCES

1. *Indian Constitution Law*, M. P. Jain 7th Edn., Lexis Nexis, 2014.

2. *Introduction to the Constitution of India*, D.D. Basu, Lexis Nexis, 2015.

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(18HS0835) PROBABILITY &STATISTICS

COURSE OBJECTIVES

The objectives of this course is to

1. *Train the students thoroughly in Mathematical concepts fundamentals of probability, test of hypothesis, Test of significance.*
2. *Prepare students for lifelong learning and successful careers using mathematical concepts of probability, test of hypothesis, Test of significance.*
3. *Develop the skill pertinent to the practice of the mathematical concepts including the Student abilities to formulate and modeling the problems, to think creatively and to Synthesize information*

COURSE OUTCOMES

On successful completion of the course, the students will be able

1. *Have acquired ability to participate effectively in group discussions*
2. *Have developed ability in writing in various contexts*

UNIT-I

Basic Probability: Probability spaces, Addition theorem, conditional probability, independence, Baye's rule.

Random variables: Discrete and Continuous random variables- distribution functions, densities and their properties. Expectation of Discrete and Continuous Random Variables, Moments

UNIT-II

Probability Distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions.

UNIT-III

Basic Statistics: Measures of Central tendency: Moments, skewness and Kurtosis. Correlation and regression – Rank correlation.

UNIT-IV

Applied Statistics:

Curve fitting: Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves (Exponential & Power curve).

Test of Hypothesis: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

UNIT-V

Test of significance: Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

TEXT BOOKS

1. *Higher Engineering Mathematics*, B.S. Grewal, Khanna Publishers, 2000
2. *Statistical methods* by S.P. Gupta, S.Chand publications. 2009
3. *Probability & Statistics* by T.K.V. Iyengar, S.Chand publications, 2008
4. *Probability & Statistics* by E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher, 2009

REFERENCES

1. *Probability & Statistics for engineers* by Dr. J. Ravichandran WILEY-INDIA publishers, 2009
2. *Probability & Statistics for Science and Engineering* by G.Shanker Rao, Universities Press, 2008
3. *Probability and Statistics for Engineering and Sciences* by Jay L.Devore, CENGAGE, 2010
4. *Probability and Statistics* by R.A. Jhonson and Gupta C.B, 2006

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(18HS0803) BIOLOGY FOR ENGINEERS

COURSE OBJECTIVES

The objectives of this course is to

1. *Describe how biological observations of 18th Century that lead to major discoveries.*
2. *Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological*
3. *Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring*
4. *Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine*

COURSE OUTCOMES

On successful completion of the course, the students will be able

1. *Classify enzymes and distinguish between different mechanisms of enzyme action.*
2. *Identify DNA as a genetic material in the molecular basis of information transfer.*
3. *Analyze biological processes at the reductionistic level*
4. *Apply thermodynamic principles to biological systems.*
5. *Identify and classify microorganisms.*

UNIT-I

Introduction & Classifications of Organisms

Introduction - classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. Model organisms - study of different groups - E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus.

UNIT-II

Genetics Purpose

Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis- Concepts of recessiveness and dominance - Concept of mapping of phenotype to genes - single gene disorders in humans - Complementation in human genetics.

UNIT-III

Biomolecules Purpose & Enzymes Purpose

Building blocks of Molecules of life & it's types. Introduction & Concepts- Monomer units and polymeric structures, Sugars, starch, cellulose, Amino acids, proteins, Nucleotides, DNA/RNA, Two carbon units and lipids.

Role of catalysis life in existed on earth Enzymology: Enzyme classification. Mechanism of enzyme action. Enzyme kinetics and kinetic parameters related to Biology. RNA catalysis. Classifications and Procedure for Enzyme catalysed reactions with two examples.

UNIT-IV

Information Transfer Purpose & Macromolecular Analysis Purpose

Molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. Genetic material of DNA, Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Introduction and Explanation of genetic code and degeneracy of genetic code. Gene - complementation and recombination.

Biological processes at the reductionist level Proteins - structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

UNIT-V

Metabolism Purpose

The principles of energy transactions - in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency- including breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions.
Microbiology -single celled organisms -species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.

TEXT BOOKS

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company

REFERENCES

1. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
2. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown

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(18CE0151) STRENGTH OF MATERIALS

COURSE OBJECTIVES

The objectives of this course is

1. *To learn about simple stresses and strains and their applications.*
2. *To learn how to find shear force and bending moment and construction of SFD & BMD.*
3. *To understand about the concept of simple bending and shear stress distribution.*
4. *To learn about deflections of Beams by using different methods.*
5. *To learn about columns and struts and their applications.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *The students would be able to understand the behaviour of materials under different stress and strain conditions.*
2. *The students would be able to draw bending moment, shear force diagram, bending stress and shear stress distribution for beams under the different conditions of loading.*
3. *The student would be able to apply knowledge to analyse concept of deflection, bending moment and shear force diagram in beams under various loading conditions.*
4. *Determine shear stress in the shaft subjected to torsional moments.*

UNIT - I

Simple Stresses and Strains: Elasticity and plasticity – Types of stresses and strains – Hooke's law – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – Composite bars – Temperature stresses.
Strain Energy: Resilience – Gradual, sudden, impact and shock loadings- Simple applications.

UNIT - II

Shear Force And Bending Moments: Types of supports – Types of beams – Shear force and bending moment diagrams for simply supported - Cantilever and over hanging beams with point loads, uniformly distributed load , uniformly varying loads and couples – Relationship between shear force and bending moment.

UNIT - III

Theory Of Simple Bending: Assumptions made in the theory of simple bending – Derivation of bending equation: M/I = f/y = E/R –Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I-Tangle and Channel sections – Design of simple beam.

Shear Stress Distribution: Derivation of formula – Shear stress distribution in rectangular, triangular, circular, I and T sections.

UNIT- IV

Deflections of Beams: Bending into a circular arc – Slope - deflection and radius of Curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads - Uniformly distributed load, uniformly varying load.

Torsion of Circular Shafts And Springs: Theory of pure torsion – Torsional theory applied to circular shafts – Power transmission - Close and open coiled helical springs under axial loads and axial twist – Carriage springs.

UNIT - V

Thin Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop , longitudinal and volumetric strains – changes in diameter and volume of thin cylinders – Riveted boiler Shells - Thin spherical shells.

Thick Cylinders: Thick cylinders – Lame's equation – Design of thick cylindrical shells – Compound cylinders – Shrink fit allowance – Initial difference of radii at the junction.

TEXT BOOKS

1. *Strength of Materials (Mechanics of Solids),* 6th Edition, Dr. R.K. Rajput, S. Chand Publishing, 2015.
2. *A Textbook of Strength of Materials*, 6th Edition, Dr. R. K. Bansal, Laxmi Publications, 2016.

REFERENCES

1. *Mechanics of Materials*, Revised, 2016 Edition, Dr. B. C. Punmia, Dr. Ashok Kr. Jain, Dr. Arun Kumar Jain, Laxmi Publications, 2016.
2. *Strength of Materials*, 3rd Edition, R. Subramanian, Oxford University Press, 2010.
3. *Strength of Materials*, 24th Edition, R. S. Khurmi, S. Chand Publishing, 2015.
4. *Strength of Materials*, 11th Edition, Sadhu Singh, Khanna Publishers, 2013.

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(18ME0304) KINEMATICS OF MACHINERY

COURSE OBJECTIVES

The objectives of this course is to

1. *Understand the basic concepts of mechanisms, cam, gear train and their kinematics.*
2. *Understand the effects of friction in the motion of machine components.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Familiarity with common mechanisms used in machines and everyday life.*
2. *Identify different mechanisms, Inversions of kinematic chains*
3. *Ability to perform analysis of different types of links, position, velocity, acceleration analyses.*

UNIT-I

Basics Of Mechanisms - Classification of links and kinematic pairs – Sliding, Turning, Rolling, Screw and spherical pairs- Lower and higher pairs- Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law

Kinematic Inversions of four-bar chain, Single and double slider crank chains –Quick return mechanisms

UNIT-II

Mechanisms With Lower Pairs - Straight line motion mechanisms, Peaucellier, Hart, Scottrussel, Grasshopper, Watt, Tchebicheff, Robert and pantograph.

Steering Mechanisms - Conditions for correct steering – Davis Steering gear, Ackermanns steering gear. Hooke's Joint (Universal coupling) -Single and double Hooke's joint — applications – Simple problems.

UNIT-III

Kinematics - Displacement, Velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration of polygons

Velocity Analysis using instantaneous centers – kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration

UNIT-IV

Cams - Classification of cams and followers – Terminology and definitions – Displacement diagrams – Uniform velocity, Parabolic, Simple harmonic and Cycloidal motions.

Cam Profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – Sizing of cams.

UNIT-V

Gears - Law of toothed gearing – Involutes and Cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – Contact ratio –Condition for constant velocity ratio for transmission of motion - Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only].

Gear Trains – Speed ratio, Train value – Parallel axis gear trains – Epicyclic Gear Trains, Differential gear of an automobile, Simple problems only.

TEXT BOOKS

1. *Theory of Machine,* S.S. Rattan, Tata McGraw-Hill, 3rd Edition, 2013.
2. *Theory of Machine,* R.S Khurmi,, S Chand Publications, 14th Edition, 2005 .
3. *Kinematics and dynamics of machinery,* R.L.Norton, Tata McGraw-Hill, 1st Edition, 2013.

REFERENCES

1. *Theory of Machines and Mechanisms,* J.E. Shigley 4rd Edition" Oxford International student Edition
2. *Theory of Machines,* Thomas bevan, Pearson (P), 3 rd Edition, 2012
3. *Mechanics of Machines,* Ramamurthy, V. Narosa Publishing House, 2002.

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(18CE0152) FLUID MECHANICS & FLUID MACHINES

COURSE OBJECTIVES

The objectives of this course is to

1. *To understand the basic concepts of Fluid properties and fluid statics.*
2. *To understand the applications of fluid kinematics and dynamics.*
3. *To understand the behavior of pipe flow and losses in pipe flow.*
4. *To understand the concepts of flow measurements and boundary layer flows.*
5. *To understand the working principles of hydraulic machinery.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *How to find frictional losses in a pipe when there is a flow between two places.*
2. *Know types of flow and its measurements and applications.*
3. *Identify the suitable pump required for different purposes.*
4. *Classify the turbines and design criteria based on water availability.*

UNIT-I

Fluid Properties: Dimensions and units - Definition of a fluid – Physical properties of fluids-Density, Specific weight, Specific volume, Specific gravity, Compressibility, Vapour pressure, Surface tension and capillarity and Viscosity.

Fluid Statics: Pascal's law, Pressure variation in a static fluid – Atmospheric, gauge and absolute pressures, Measurement of pressure – Piezometer – U–tube and inverted U–tube manometers and Bourdon's pressure gauge, Hydrostatic forces on plane and curved surfaces, Center of pressure.

UNIT-II

Fluid Kinematics: Types of flow – Streamline – Streak line – Path line – Stream tube – Control volume – Continuity equation in one and three dimensional forms – Stream function and velocity potential function – Flow net – Acceleration of a fluid particle – Local and convective accelerations – Tangential and normal accelerations.

Fluid Dynamics: Euler's equation of motion along a streamline – Bernoulli's energy equation – Energy correction factor – Impulse–momentum equation – Momentum correction factor – Force on a bend – Energy gradient line – Hydraulic gradient line – Analysis of free liquid jets – Forced vortex and free vortex.

UNIT-III

Analysis of Pipe Flow: Reynolds's experiment – Reynolds's number - Minor losses in pipe flow - Darcy–Weisbach 1equation – Variation of friction Factor – Moody's chart – Pipes in series – Pipes in parallel, Boundary Layer Theory.

Flow Measurement: Velocity measurement by Pitot tube and Pitot static tube – Discharge measurement by Venturimeter and orifice meter – Orifices and mouthpieces

UNIT-IV

Dimensional Analysis and Similitude: Introduction, dimensions; dimensional homogeneity; Methods of dimensional analysis- Rayleigh's method; Buckingham – Pi theorem. Similitude - Types of Similarities. Model Laws.

UNIT-V

Hydraulic Turbines: Elements of hydroelectric power plants- Heads and efficiencies of turbines – Classification of turbines –Pelton Wheel-Modern Francis turbine – Kaplan turbine. Main components and working principle- Expressions for work done and efficiency – Working proportions and design of each.

Centrifugal Pumps: Classification and types of pumps – Components and working of a centrifugal pump – Work done by the impeller– Heads and efficiencies – Net positive suction head(NPSH)- Priming – Priming devices – Minimum starting speed – Multistage pumps – Pumps in series and parallel – Submersible pumps – Limiting suction head – Cavitation – Expression for specific speed.

TEXT BOOKS

1. *Hydraulics and Fluid Mechanics Including Hydraulics Machines (A-4-Size)*, 20th Edition, Dr. P.N. Modi & Dr. S.M. Seth, Standard Book House, 2015.
2. *A Textbook of Fluid Mechanics and Hydraulic Machines*, 9th Edition, Dr. R. K. Bansal, Laxmi Publications, 2016.
3. *Fluid Mechanics*, 9th Edition, Victor Streeter, E. Benjamin Wylie, K.W. Bedford, McGraw Hill Education, 2010.

REFERENCES

1. *Fluid Mechanics and Machinery, 1st Edition, C.S.P.Ojha, P.N.Chandamouli & R.Berndtsson, Oxford University Press, 2010.*
2. *Fluid Mechanics and Hydraulic Machines, 1st Edition, S. C. Gupta, Pearson India Education Services Pvt. Ltd, 2006.*
3. *Fluid Mechanics and Machinery, 1st Edition, Rama Durgaiah D., New Age International, 2002*

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(18ME0305) MATERIAL TESTING LAB

COURSE OBJECTIVES

The objectives of this course is to

1. *Experiments to find Types of Metals, Steels, Cast irons and their Microstructures;*
2. *To determine Mechanical Properties of Various Engineering materials*

Course Outcomes:

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

1. *Prepare metallographic samples for microscopic examinations.*
2. *Analyze the microstructure and estimate the amount of porosity and grain size of the casted specimen.*
3. *Analyze the mechanical Properties of Various Engineering materials*

List of Experiments

1. Preparation and study of the Micro Structure Iron.
2. Preparation and study of the Micro Structure Cu.
3. Preparation and study of the Micro Structure Al.
4. Preparation and study of the Microstructure of low carbon steels.
5. Study of the Micro Structures of Non-Ferrous alloys
6. Study of the Micro structures of Heat treated steels.
7. Bending test on simple support beam.
8. Compression test on wood or Brick.
9. Impact test on metal specimen (Izod and Charpy).
10. Compression test on helical spring.
11. Tension test on mild steel rod.
12. Torsion test on mild steel rod.

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(18ME306) MACHINE DRAWING LAB

COURSE OBJECTIVES

The objectives of this course is to

1. *To make the students to understand the concepts of Indian Standard conventions, methods of dimensioning, the title boxes, to draw the machine elements and simple parts.*
2. *To make the students to understand and draw assemblies of machine parts and to draw their sectional views.*
3. *To develop the imagination and drafting skills of students.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Students can understand the working principles of an assembly or subassembly so that he/she will be able to produce the final product by procuring the units from various sources/suppliers and still produce any useful product serving effectively.*
2. *The drawings can be easily prepared and understood by the people in a manufacturing industry.*

List of Experiments

1. **Exercises on machine drawing conventions using drafting software.**
   - Conventional representation of materials.
   - Conventional representation of machine components.
   - Conventional representation sectional views.
   - Conventional representation of limits, Fits and tolerances-form and positional tolerances and machining symbols.
   - Conventional representation of dimensioning on the drawings.
2. **Exercises on drawing of machine elements and simple parts using drafting software.** (Any three exercises out of five)
   - Types of thread profiles-Square, Metric, ACME, Worm.
   - Bolted joints-Hexagonal bolt and nut, Square bolt and nut.
   - Locking arrangements for nuts-Locking by split pin, castle nut.
   - Foundation bolts- Eye, Bent, Rag foundation bolts.
   - Keys-Saddle key, Sunk key, Woodruff key.

3. Assembly drawings.

Drawing of assembled views for the part drawings of the following, using conventions and easy drawing proportions. (Any three ONLY)

- Stuffing boxes
- Eccentrics
- Petrol Engine-connecting rod
- Screw jack
- Machine vice

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(18CE0153) FLUID MECHANICS & FLUID MACHINES LAB

COURSE OBJECTIVES

The objectives of this course is to

1. *To learn the concepts of Venturimeter & Orifice meter*
2. *To learn the concepts of notch's*
3. *To learn the basic concepts of turbines*
4. *To learn the basics concepts of different types of pumps.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Calibrate Venturimeter & Orifice meter*
2. *Calculate losses in flows*
3. *Estimate the efficiency of different pumps.*
4. *Study the performance of different turbines.*

List of Experiments:

Cycle 1:

1. Verification of Bernoulli's equation.
2. Calibration of Coefficient of discharge for Venturimeter.
3. Calibration of Coefficient of discharge for Orifice meter.
4. Calibration of Friction factor. (major losses experiment)
5. Determination of loss of head due to sudden contraction. (minor losses experiment)
6. Calibration of Discharge over Notches (Rectangular/Triangular Notch.)
7. Determination of Coefficient of discharge for a small orifice / mouthpiece by a constant head method / variable head method.

Cycle 2:

8. Impact of jet on vanes.
9. Performance test on Pelton wheel turbine.
10. Performance test on Francis turbine.
11. Efficiency test on centrifugal pump.
12. Study on Hydraulic jump.
13. Performance test on Kaplan turbine

***Minimum Four experiments** must be conducted in the lab from each cycle

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(18HS0804) ENVIRONMENTAL SCIENCES

COURSE OBJECTIVES

The objectives of this course is to

1. *Students have got an idea about the importance of pollution free air, water, soil and food.*
2. *They know about global environmental problems like Acid Rains, Global Warming, Green House Effects, Ozone layer depletion.*
3. *To understand the impacts of developmental activities and mitigation measures along with the environmental policies and regulations.*
4. *To recognize major concepts in environmental studies and demonstrate in-depth understanding the environment.*

COURSE OUTCOMES

On successful completion of the course, the students will be able

Based on this course, the Engineering Student will be able to understand/evaluate/develop technologies on the basis of Ecological principles and environmental regulations along with Legislation, Laws and Policies which in turn help in sustainable development.

1. *Take preventive measures to reduce air, water, soil pollutions and contaminants in food.*
2. *Effectively carry out waste disposal at individual level.*
3. *Involve in preservation of natural resources.*

UNIT- I

Introduction:

Definition, Scope and Importance-Need for Public Awareness

Natural Resources:

Classification of resources-Forest resources: Use and over-exploitation, deforestation- Mining, dams and their effects on forests 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 –Energy resources: Renewable and Non- Renewable sources of energy- Solar energy, Hydro electrical energy, Wind energy, Nuclear energy, etc.

UNIT-II

Ecosystems:

Concept of an ecosystem– structural features of ecosystem- Producers, Consumers and Decomposers–- Biogeochemical cycles- Ecological succession-Food chains, food webs and ecological pyramids – Energy flow in the ecosystem-Types of ecosystems (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems.

UNIT-III

Biodiversity and its Conservation:

Introduction, Definition, genetic, species and ecosystem diversity, Bio-geographical classification of India, India as a Mega-diversity Nation, Hot spots of biodiversity, Value of biodiversity, threats to biodiversity, endemic, endangered and extinct species of India, In-Situ and Ex-situ conservation of biodiversity.

UNIT-IV

Environmental Pollution and Global Environmental Issues:

Natural Disasters: Droughts, Floods, Cyclone, Landslides, Earthquake,

Pollution episodes: Air pollution, Water pollution, Land pollution, Noise pollution, Automobile pollution and Nuclear pollution –Effects-Global warming, Acid Rain and Ozone layer depletion and controlling measures.

Global Environmental Issues: Population Growth, Urbanizations, Land Management, Water and Waste Water Management. Climate change and impacts on human environment

Solid Waste Management: causes, effects and control measures of Municipal solid wastes – E-waste and management, Role of an individual in prevention of pollution – pollution case studies.

UNIT-V

Environmental Legislation, Laws, Policies For Sustainable Development:

Environmental Legislation, Environmental Protection act – Air Prevention and Control of Pollution act– Water Prevention and control of Pollution act– Wildlife protection act – Forest conservation act – Municipal Solid Waste management, International conventions/Protocols : Earth summit, Kyoto protocol and Montreal Protocol. From Unsustainable to sustainable development, Role of NGO's for Sustainable development, Concepts of Green belt development, Role of IT in Environment-Remote Sensing and GIS methods for Sustainable development.

Field work- visit to a local area to document environmental assets-river forest grassland/hill, mountain and polluted sites (urban/rural/industrial/Agriculture)- study simple ecosystems (pond/river/hill slopes)

TEXT BOOKS

1. *Environmental Sciences*, A.Kaushik and C.P.Kaushik, 5th edition, New age international publishers, 2015.
2. *Text Book of Environmental Science and Technology* by M.Anji Reddy, BS Publications, 2009
3. *Environmental Studies-From Crisis to Cure*, Rajagopalan.R, Oxford University Press, 2005.

REFERENCES

1. *Environmental Studies*, Anil Kumar and Arnab Kumar De New Age International Publishers, New Delhi, 3rd Edition 2015.
2. *Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards*, R.K. Trivedi Vol.I and II, Enviro Media, 2001
3. *Environmental Studies* Dr.K.Mukkanthi, S.Chand Publishers, 2002
4. *Text Book of Environmental Studies*, Erach Bharucha, University Grants Commission, University Press (India) Pvt.Ltd., Hyderabad,2010

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(18ME0307) NON- CONVENTIONAL ENERGY RESOURCES

COURSE OBJECTIVES

The objectives of the course is to

1. *Know the importance of energy, resources of renewable energy, their usage and impact on environment.*
2. *Recognize the significance of Solar energy, its harnessing technologies & its applications*
3. *Identify the method of exploiting energy from wind and parameters to be considered for the selection of site for wind turbine installation*
4. *Explain the concept of bio energy and its conversion devices*
5. *Differentiate various renewable energies such as tidal energy, geothermal energy, fuel cells etc.*

COURSE OUTCOMES

On successful completion of the course, the student will be able to

1. *State various sources of Energies, its availability and explain the importance of them by observing the global energy scenario.*
2. *Distinguish the types of solar energy tapping devices and describe the method of harnessing the solar energy.*
3. *Summarize the Wind energy systems and elucidate the impact of it in environmental aspects.*
4. *Describe the Biomass conversion process and list out various bioenergy applications.*
5. *Interpret the knowledge of renewable energies such as tidal energy, OTEC, Fuel cell, etc. for effective construction of Hybrid systems.*
6. *Identify numerous applications renewable energy resources and illustrate its harnessing technologies*

UNIT-I

Introduction -World Energy Use – Classification of Energy's-Reserves of Energy Resources – Environmental Aspects of Energy Utilization – Need of Renewable Energy– Renewable Energy Scenario in India and around the World.

Solar radiation - Measurements and Estimations

UNIT-II

Solar thermal conversion - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation

Photo voltaic Conversion: Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

UNIT-III

Wind Energy - Types of Wind Energy Systems – Performance – Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects.

UNIT-IV

Bio – Energy- Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel – Cogeneration - Biomass Applications

UNIT-V

Other Sources of Energy - Ocean Thermal Energy Conversion –Geothermal Energy – Hydrogen and Storage - Fuel Cell Systems – Hybrid Systems.

TEXT BOOKS

1. R.K. Rajput, *Non-conventional Energy Sources and Utilization*, S. Chand Publishers, 2nd Edition, 2014.
2. G. D Rai, *Non-Conventional Energy Sources,* Khanna Publishers, 1st Edition, 2010.
3. Nicholas Jenkins & Janaka Ekanayake, *Renewable Energy Engineering*, Cambridge University Press; 1st Edition, 2017.

REFERENCES

1. Dr. R K Singal, *Non-Conventional Energy Resources*, S.K Kataria & Sons, 4th Edition, 2014.
2. John Twidell & Tony Weir, *Renewable Energy Sources*, Routledge publisher, 3rd Edition, 2015.
3. Sukhatme. S.P, *Solar Energy, Principles of Thermal Collection and Storage,*Tata McGraw Hill Publishing Company Limited, 6th Edition, 1990.

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(18EE0240) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE OBJECTIVES

The objectives of this course is to

1. *To understand the nature of different circuit elements, fundamental laws and network Theorems.*
2. *Understand the operation of dc machines and single phase transformers.*
3. *Understand the characteristics of the p-n junction diode.*
4. *Understand the characteristics of BJT,FET,MOSFET and characteristics of special purpose electronic devices.*

COURSE OUTCOMES

On successful completion of the course, the students will be able

1. *Determine the equivalent impedance of given network by using network reduction techniques.*
2. *Determine the current through any element and voltage across any element*
3. *Apply the network theorems suitably.*
4. *Analyze the operating principles of motor and transformer.*
5. *Analyze the operating principles of major electronic devices, its characteristics and applications.*
6. *Design and analyze the DC bias circuitry of BJT and FET.*

PART-A

UNIT – I

Introduction to Electrical Engineering

Ohm's Law, Basic Circuit Components, Kirchhoff's Laws, Types of Sources, Resistive Networks, Inductive Networks, Capacitive Networks, Series Parallel Circuits, Star Delta and Delta Star Transformation. Principle of AC Voltages, Root Mean Square and Average Values of Alternating Currents and Voltage, Form Factor and Peak Factor, Phasor Representation of Alternating Quantities.

UNIT- II

Network Theorems: Thevenin's, Norton's, Maximum Power Transfer, Reciprocity and Superposition Theorems for DC Excitations.

Two Port Networks: Two Port Network Parameters – Impedance, Admittance, Transmission and Hybrid Parameters and Their Relations.

UNIT-III

DC Motors: Principle of Operation of DC Motors, Types of DC Motors, Torque Equation, Losses and Efficiency Calculation in DC Motor - Swinburne's Test and Applications.

Transformers: Principles of Operation, EMF equation, Losses and Efficiency, Regulation of Transformer, Testing: OC & SC Tests.

PART-B

UNIT-I

Semiconductor Devices: Intrinsic semiconductors-Electron-Hole Pair Generation, Conduction in Intrinsic Semiconductors, Extrinsic Semiconductors-N-Type and P-Type Semiconductors, Comparison of N-Type and P-Type Semiconductors. The p-n Junction –Drift and Diffusion Currents, The p-n Junction Diode-Forward Bias, Reverse Bias, Volt-Ampere Characteristics- Diode Specifications, Applications of Diode, Diode as a Switch. Diode as a Rectifier-Half-wave Rectifier, Full-Wave Rectifier, Full-Wave Bridge Rectifier, Rectifiers with Filters, Zener Diode-Volt-Ampere Characteristics, Zener Diode as Voltage Regulator.

UNIT-II

BJT: Bipolar Junction Transistor (BJT) – Types of Transistors, Operation of NPN and PNP Transistors, Input-Output Characteristics of BJT-CB, CE and CC Configurations, Relation between IC, IB and IE. Transistor Biasing- Fixed Bias, Voltage Divider Bias,Transistor Applications- Transistor as an Amplifier, Transistor as a Switch.

UNIT-III

JFET & MOSFET: Junction Field Effect Transistor (JFET)- Theory and Operation of JFET, Output Characteristics, Transfer Characteristics, Configurations of JFET-CD, CS and CG Configurations, JFET Applications- JFET as an Amplifier, JFET as a Switch, Comparison of BJT and JFET,MOSFET-The Enhancement and Depletion MOSFET, Static Characteristics of MOSFET, Applications of MOSFET.

TEXT BOOKS

1. *Basic Electrical Engineering*, M.S.Naidu and S. Kamakshiah – TMH, 2007
2. *Basic Electrical Engineering*, T.K.Nagasarkar and M.S. Sukhija Oxford University Press, 2004
3. *Theory and Problems of Basic Electrical Engineering*, D.P.Kothari & I.J. Nagrath PHI, 2008

REFERENCES

1. *Principles of Electrical Engineering*, V.K Mehta, S.Chand Publications, 2007
2. *Fundamentals of Electrical Electronics Engineering*, T.Thyagarajan, SCITECH Publications 5th Edition-2007.

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(18ME0308) MANUFACTURING PROCESSES

COURSE OBJECTIVES

The objectives of this course is to

1. *Understand the various manufacturing processes and machining related to casting, joining of metals, moulding and advanced processes.*
2. *Metal forming, extrusion, processing of plastic materials and rapid manufacturing processes are highly nonlinear because they involve geometric, material and contact non linearity and hardening, hot and cold working process.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Demonstrate knowledge of engineering principles (metallurgy, mechanics, and/or material science) in manufacturing processes.*
2. *Use appropriate machine tool equipment, standardized methods and apparatus or manufacturing processes.*
3. *Use finite element software to simulate physical behaviors of mechanical structures or systems.*
4. *Apply FEA principles for component and assembly design*

UNIT-I

Metal Casting Processes -Sand Casting – Sand Mould – Type of patterns – Pattern Materials – Pattern allowances – Moulding sand Properties and testing – Cores –Types and applications – Moulding machines – Types and applications– Melting furnaces. Principle of special casting processes- Shell, Investment – Ceramic mould – Pressure die casting –Centrifugal Casting – CO2 process – Stir casting - Defects in casting.

UNIT-II

Joining Processes - Fusion welding processes – Type of Gas welding – Flame characteristics – Filler and Flux materials – Arc welding, Electrodes, Coating and specifications – Principles and types of Resistance welding – Solid state welding – Laser beam welding - Gas metal arc welding –Submerged arc welding – Electro slag welding – Gas Tungsten arc welding - Electron Beam Welding- Weld defects – Brazing and soldering – methods and process capabilities –Adhesive bonding, Types and applications.

UNIT-III

Metal Deformation Processes- Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – Characteristics of the processes – Typical forging operations. Rolling of metals – Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts – Principle of rod and wiredrawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion.

UNIT-IV

Sheet Metal Forming Processes - Sheet metal characteristics – Typical shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal– Metal spinning. Introduction to High energy rate forming, magnetic pulse forming, peen forming, Superplastic forming – Micro forming.

UNIT-V

Manufacture of Plastic Components- Types and characteristics of plastics –Moulding of thermoplastics – working principles and typical applications – injection moulding – Plunger and screw machines – Compression mounding, Transfer Moulding –Typical industrial applications Introduction to blow moulding –Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics.

TEXT BOOKS

1. *Elements of workshop Technology*, S.K Hajra Chouldhary and AK Hajra Choudhury, Volume I and II, Media promoters and Publishers Private Limited, Mumbai, 1997
2. *Manufacturing Technology Foundry, Forming and Welding*, P.N. Rao, , 4th Edition, Tata Mc Graw Hill, 2003
3. *Manufacturing Technology*, Kalpakjian, Pearson Education India Edition, 2006

REFERENCES

1. *Production Technology*, R.K. Jain, Khanna Publishers, 17th edition, 2012
2. *Materials and Process in Manufacturing*, Paul Degarma E, Black J.T and Ronald A.Kosher, 8th Edition, Prentice – Hall of India, 1997.
3. *Principles of Metal Castings*, Rosenthal, 2nd Edition, Tata Mc Graw Hill, 2001
4. *Manufacturing Technology*, R.K. Rajput, 1st Edition, Laxmi Publishers, 2007

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(18ME0309) THERMODYNAMICS

COURSE OBJECTIVES

The objectives of this course is to

1. *To understand the basic laws of thermodynamics and their application to the non-flow and flow processes.*
2. *To understand the thermodynamic properties of ideal and real gases, gaseous mixtures.*
3. *To get the awareness on thermodynamic principles, skills to perform the analysis and design of thermodynamic systems.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Apply the laws of thermodynamics to analyze thermal systems.*
2. *Can understand the energy transformation from one system to other system.*
3. *Can understand the working principles of I.C. Engines.*

UNIT-I

Basic Concepts: Definitions of system, boundary, surrounding control volume. Types of thermodynamic systems, Properties of system, definitions for properties like pressure, volume, temperature, enthalpy, internal energy, density, with their units. State, Property, Process and Cycle, Quasi Static Process, Thermodynamic Equilibrium.

Work & Heat Transfer: Work transfer, Types of work transfers, Point and Path Functions, Heat transfer, Comparison of Work and Heat transfers.

UNIT-II

Zeroth Law of Thermodynamics: Zeroth Law of Thermodynamics. Heat and temperature - concept of thermal equilibrium

First Law of Thermodynamics: First law of thermodynamics- simple problems on heat and work conversions in process and cycle. Non flow energy equation (NFEE), Steady flow energy equation (SFEE).Limitations of First law of thermodynamics.

Second Law of Thermodynamics: Heat Engine, Statements of Second law and their equivalence, Refrigeration and Heat Pump, Reversibility and Irreversibility, availability and unavailability – concept of change in entropy – expression for change in entropy.

UNIT-III

Law of Perfect Gas: Ideal Gas, Equation of State, Avogadro's Law, Internal Energy and Enthalpy of Ideal Gas, Entropy Change of Ideal Gas, Mixture of Gases- Dalton's Law of Partial Pressure, Specific Heats, Internal Energy and Enthalpy of Gas.

Thermodynamic Processes on Gases: Flow process, Non Flow Process, P –V and T-S diagrams on Isochoric process, Isobaric, Isothermal process, Isentropic process, Polytrophic process. Problems on Non flow Processes.

UNIT-IV

Thermodynamic Cycles: Carnot Cycle, Sterling Cycle, Ericson Cycle, Otto Cycle, Diesel Cycle, Dual Cycle, Problems.

Pure Substances: P-V, P-T, T-S diagrams of Pure Substances, Mollier Diagram, Dryness Fraction, Enthalpy and Entropy of Steam using Steam Tables. Problems.

UNIT-V

Boilers: Classifications of Boiler, Water Tube boilers- Bob cocks and Will cocks , Benson, Lamount boilers and Fire Tube boilers- Cochcraon boiler

Boiler mountings and Accessories–pressure gauge, water level indicator, fusible plug, blow down cock, stop valve, safety valve– feed pump, economizer, super heater and air pre-heater. Problems on Performance of Boiler and Heat balance sheet.

Irreversibility and Availability, Availability functions for systems and Control volumes undergoing different processes, Loss of work. Second law analysis for a control volume.

TEXT BOOKS

1. *Engineering Thermodynamics*, P K Nag, Tata McGraw Hill, 6th Edition, 2013
2. *Thermal Engineering*, R.K.Rajput, Lakshmi Publications, 7th Edition, 2015
3. *Thermal Engineering*, P.L.Balleny, Khanna Publications, 9th Edition.2009

REFERENCES

1. *Thermodynamics* - An Engineering Approach, Yunus A Cengel / Michael A Boles, Tata McGraw Hill India, 7e,Special Indian Edition 2011.
2. *Thermodynamics and Heat Engines*, Yadav R., Vol 1, Central Publishing House, 2011.
3. *Engineering Thermodynamics*, J.B. Jones and R.E.Dugan.,Prentice Hall of India, 2010.
4. *Basic Engineering Thermodynamics*, T. Roy Choudry, Tata McGraw Hill, Second Edition 2012.

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(18ME0310) THEORY OF MACHINES

COURSE OBJECTIVES

The objectives of this course is to

1. *To understand the static and dynamic force analysis of Mechanisms.*
2. *To understand the static and dynamic balancing of rotating and reciprocating masses, concept of free and forced vibration and their analysis.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Understand and apply the basic principles of dynamics.*
2. *Relate the motion of parts in a machine using the principles of kinematics*

UNIT -I

Precession- Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero planes and ships.

Turning Moment Diagrams and Fly Wheels: Turning moment diagrams for steam engine, IC Engine and multi cylinder engine. Crank effort - Coefficient of Fluctuation of energy, Coefficient of Fluctuation of speed – Fly wheels and their design, Fly wheels for Punching machines.

UNIT-II

Clutches - Friction clutches- Single Disc or plate clutch, Multiple Disc Clutch, Cone Clutch, Centrifugal Clutch

Brakes and Dynamometers - Simple block brakes, Band brake, internal expanding brake, braking of vehicle. Dynamometers – absorption and transmission types-Prony brake, Rope brake, Epicyclic-train & torsion dynamometers- General description and methods of operation.

UNIT-III

Governors - Watt, Porter and Proell governors. Spring loaded governors – Hartnell and Hartung governors with auxiliary springs. Sensitiveness, isochronism and hunting. Effort and power of a governor.

UNIT-IV:

Balancing - Balancing of rotating masses - single and multiple – single and different planes **Balancing of Reciprocating Masses:** Primary and Secondary balancing of reciprocating masses. Analytical and graphical methods. Unbalanced forces and couples – V-engine, multi cylinder in- line and radial engines for primary and secondary balancing.

UNIT-V

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

TEXT BOOKS

1. *Theory of Machines, R.S.* Khurmi, Khanna Publishers, 2003.
2. *Theory of Machines*, S. S. Ratan, Tata McGraw Hill, 2 nd Edition, 2005
3. *Theory of Machines*, Thomas Bevan, CBS Publishers, 3rd Edition, 1984

REFERENCES

1. *Theory of Mechanisms and Machines*, Ghosh A. and Mallick A.K, Affiliated Pvt.Ltd., 1988.
2. *Theory of Machines and Mechanisms*, Shigley J.E. and Uicker J.J., McGraw-Hill,Inc., 1995.
3. *Mechanism and Machine Theory*, J.S Rao. And R.V Dukkipati, Wiley-Eastern Limited 1992.

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(18ME0311) MANUFACTURING PROCESSES LAB

COURSE OBJECTIVES

The objectives of this course is

1. *Understand the various manufacturing processes and machining related to casting, forming, joining of metals, moulding and extrusion processes of plastic materials.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Demonstrate knowledge of engineering principles (metallurgy, mechanics, and/or material science) in manufacturing processes.*
2. *Use appropriate machine tool equipment, standardized methods and apparatus for manufacturing processes.*

I. Metal Casting Lab:

a. Pattern Design and making - for casting drawing.
b. Sand properties testing - Exercise -for strengths, Moisture, Grain size and permeability
c. Moulding: and Casting

II. Welding Lab:

a. Arc Welding: Lap & Butt Joint
b. Spot Welding

III. Mechanical Press Working:

a. Blanking & Piercing operation and study of simple, compound and progressive press tool.
b. Hydraulic Press: Deep drawing and extrusion operation.

IV. Processing of Plastics:

a. Injection Moulding
b. Blow Moulding

V. Soldering Processing

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(18EE0241) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB

COURSE OBJECTIVES

The objectives of this course is to

1. *Enhance the student with knowledge on electrical and electronic equipment's.*

COURSE OUTCOMES

On successful completion of the course, the students will be able

1. *Understand all the fundamental concepts involving electrical engineering.*
2. *Understand all the fundamental concepts involving electronics engineering.*

PART – A
BASIC ELECTRICAL ENGINEERING LAB

1. Verification of Superposition Theorem.
2. Verification of Thevenin's Theorem.
3. Determination of Open circuit and Short circuit parameters
4. Swinburne's Test on DC Shunt Machine (Predetermination of Efficiency of a Given DC Shunt Machine Working as Motor and Generator).
5. Brake Test on DC Shunt Motor. Determination of Performance Characteristics.
6. OC & SC Tests on Single-Phase Transformer (Predetermination of Efficiency and Regulation at Given Power Factors).

PART – B
ELECTRONICS LABORATORY
(Any Six Experiments)

1. P-N Junction Diode and Zener Diode Volt-Ampere Characteristics.
2. Bipolar Junction Transistor in CB Configuration-Input and Output Characteristics, Computation of α.
3. Half-Wave Rectifier- a) Without Filter b) With Capacitor Filter.
4. Full-Wave Rectifier- a) Without Filter b) With Capacitor Filter.
5. Bipolar Junction Transistor in CE Configuration-Input and Output Characteristics, Computation of β.
6. Junction field effect Transistor in Common Source Configuration Output and Transfer Characteristics.
7. Verification of Logic Gates- AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.

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(18HS0817) ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

COURSE OBJECTIVE

The course aims at imparting basic principles of thought process, reasoning and inference. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. The course focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system.

UNIT-I

- Basic structure of Indian Knowledge System: Astadash Vidya- 4 ved
- 4 Upaved (Ayurved, Dhanurved, Gandharva Ved & Sthapthya Adi.,)

UNIT-II

- 6 Vedanga (Shisha, Kalppa, Nirukha, VYkaran, Jyothish & Chand)
- 4 Upanga (Dharma Shastra, Meemamsa, Purana & Tharka Shastra)

UNIT-III

- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case studies

UNIT-IV

- Philosophical Tradition (Sarvadarshan) Nyaya, Vyshepec,Sankhya, Yog, Meemamsa, Vedantha, Chavanka, Jain & Boudh
- Indian Linguistic Tradition –(Phonology, morphology, syntax and semantics)

UNIT-V

- Indian Artistic Tradition - Chitra kala, Moorthi kala, Vasthu kala , Sthapthya, Sangeetha, Nruthya Yevam Sahithya
- Case studies

TEXT BOOKS

1. *Cultural Heritage of India-course material*, V. Sivaramakrishnan (Ed.), Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014
2. *Modern Physics and Vedant*, Swami Jitatmanand, Bharatiya Vidya Bhavan, 2011

REFERENCES

1. *Tao of Physics*, Fritzof Capra, 2012
2. *Holistic Science and Vedant*, Swami Jitatmanand Bharatiya Vidya Bhavan, 2012

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(18HS0860) SUPPLY CHAIN MANAGEMENT

COURSE OBJECTIVES

The objectives of this course is to

1. *Understand the role of distribution of logistics and supply chain management in an economy.*
2. *Know the concepts of SCM such as outsourcing, distribution strategies, planning for uncertainty, decision making.*
3. *Design the SCM network based on the demand and inventory and analyze its impact*
4. *Provide an insight in to the role of IT in supply chain management.*
5. *Concentrate on the integration of SCM in Agriculture sector*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Appreciate the evolution and identify the role of supply chain management in the economy.*
2. *Identify and evaluate the drivers of supply chain management.*
3. *Analyze the importance of make or buy decisions and identify appropriate suppliers.*
4. *Appraise the importance of supply chain networks.*
5. *Assess the risk associated with supply chain practices and take better decisions.*
6. *Familiarize with and apply various computer based supply chain optimization tools.*

UNIT-I

Role of Distribution in Value Discovery: Designing of distribution logistics system – Outsourcing of distribution logistics – Distinction between distribution logistics and supply chain management- Introduction - Supply Chain – Fundamentals –Evolution-Role in Economy - Importance - Decision Phases - Supplier- Manufacturer-Customer chain. - Enablers/Drivers of Supply Chain Performance. Supply chain strategy - Supply Chain Performance Measures.

UNIT-II

Strategic Sourcing - Outsourcing – Make Vs Buy - Identifying core processes - Market Vs Hierarchy - Make Vs Buy continuum -Sourcing strategy - Supplier Selection and Contract Negotiation- Supplier Development - World Wide Sourcing.

UNIT-III

Supply Chain Network - Distribution Network Design – Role – Factors Influencing Options, Value Addition – Distribution Strategies - Models for Facility Location and Capacity allocation- Distribution Center Location Models. Supply Chain Network optimization models. Network Design decisions using Decision trees.

UNIT-IV

Planning Demand, Inventory And Supply - Managing supply chain cycle inventory- Uncertainty in the supply chain –- Analyzing impact of supply chain redesign on the inventory - Risk Pooling - Managing Inventory for short life – cycle products - multiple item -multiple location inventory management. Pricing and Revenue Management

UNIT-V

Current Trends - Supply Chain Integration - Building partnership and trust in SC Value of Information: Bullwhip Effect - Effective forecasting - Coordinating the supply chain. . SC Restructuring - SC Mapping -SC process restructuring,–IT in Supply Chain- Agile Supply Chains- Reverse Supply chain.-Agro Supply Chains.

TEXT BOOKS

1. DK Agarwal, *Textbook of Logistics and supply chain management*, Lakshmi Publications, 3rd Edition, 2016.
2. Janat Shah, *Supply Chain Management Text and Cases*,2nd Edition, Pearson Publishers, 2016.

REFERENCES

1. Donald Bowersox and David Closs and M. Bixby Cooper, *Supply chain Logistics Management*,4th Edition, TMH, 2013.
2. Rahul V. Altekar, *Supply chain management: Concepts and Cases*, 2nd Edition, PHI, 2012
3. UpendraKachru, *Exploring Supply Chain: Theory and Practice*, 1st Edition, Excel Books, 2009.

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(18ME0312) CAD/CAM

COURSE OBJECTIVES

The *objectives of this course to:*

1. *Gain Knowledge in handling 2-D drafting and 3-D modeling software systems*
2. *Understand the basics of synthetic curves representations*
3. *Comprehend the manual part programming and know the applications of it to CNC Machines.*
4. *Recognize the applications of computer in various aspects in manufacturing viz..Design, proper planning, manufacturing cost, layouts and material handling*
5. *Identify the need of integration of CAD and CAM*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Apply geometric transformation techniques in CAD.*
2. *Formulate the mathematical models to represent curves and surfaces.*
3. *Design engineering components using solid modeling techniques.*
4. *Understands about NC and CNC systems, Group Technology and FMS*
5. *Create programs for CNC to manufacture industrial components.*
6. *Summarize the different types of techniques used in MRP-I & MRP-II.*

UNIT I

Introduction of Automation, Product cycle, CAD, CAM and CIM -CAD Tools, CAM Tools- Utilization in an Industrial Environment-Evaluation criteria CAD standards- CAD data structure

Computer Graphics: Co-ordinate systems- Graphics package functions- 2D and 3D transformations, Translations, Scaling, Rotation about a Fixed Point, Reflections and Shears- homogeneous transformations.

UNIT II

Geometric Modeling: Various construction methods, Wire frame modeling- Synthetic curves and their representations, Bezier curve, B-spline curves, Rational curves- Surface modeling.

Solid Modeling: Solid representation- Fundamentals-Introduction to boundary representations- constructive solid geometry- Analytical solid modeling.

UNIT III

Numerical Control (NC): Introduction- Basic components of NC system-NC Procedure-NC Coordinate system-NC Motion control system-Application of NC

CNC Part Programming: Fundamentals-Canned cycles- Cutter radius compensation, Length compensation- Computed Assisted part programming using APT.

UNIT IV

Group Technology: Part families, Parts classification and coding, Production flow analysis, Machine cell design.

FMS: Introduction, Components of FMS, Material handling systems, Computer control systems, advantages of FMS

Computer Aided Quality Control: Terminology in Quality control, Inspection and testing, Contact inspection methods, optical and non-optical, integration of CAQC with CAD and CAM

UNIT V

Computer Aided Processes Planning: Retrieval type and Generative type-benefits Machinability data systems-Computer generated time standards.

Computer Integrated Production Planning: Capacity planning- shop floor control-MRP-I, MRP-II-CIMS benefits.

TEXT BOOKS

1. A Zimmers & P.Groover, *CAD/CAM*, PE Publishing, 5th Edition, 2008.
2. P.N. Rao, *CAD/CAM-Principles and applications*, TMH, 3rd Edition, 2010.

REFERENCES

1. Radhakrishnan and Subramanian, *CAD/CAM/CIM*, New Age, 3rd Edition, 2008.
2. Ibrahim Zeid&R. Sivasubramaniam, *CAD/CAM Theory and Practice*, 2nd Edition, TMH, 2010
3. K.Lalit Narayan, K.MallikarjunaRao& MMM Sarcar, *Computer Aided Design and Manufacturing*, 2nd Edition, PHI, 2008.

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(18ME0313) DESIGN OF MACHINE ELEMENTS-I

COURSE OBJECTIVES

The objectives of this course is to

1. *Familiarize the various steps involved in the Design Process.*
2. *Understand the principals involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.*
3. *Know to use standard practices and standard data.*
4. *Learn to use catalogues and standard machine components.*
5. *Make the student understand about Bolted joints, Keys and Couplings.*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Apply design procedures using theories of failure for different elements.*
2. *Design simple components under cyclic loading using Goodman's and Soderberg's criterions.*
3. *Intend Bolted joints with pre stress and joints under eccentric loading.*
4. *Design and analyze riveted joints with different configuration, boiler shell joint and eccentric loading of riveted joints and bolted joints.*
5. *Implement the concepts to design cotter joint, knuckle joint and shafts.*
6. *Explain the design procedure of various key, rigid and flexible shaft couplings.*

UNIT - I

Introduction: Concept of Design, Types of design, General considerations and standards of design, Design procedure, Selection of engineering materials, Properties, Manufacturing considerations in the design, BIS codes of materials, Preferred numbers.

Stress in Machine Members: Simple stresses, Torsional and Bending stresses, Combined stresses, Impact stresses, Stress-strain relation, Failure from static loading, Types of failure from static loading, Modes of failures, factor of safety

UNIT-II

Design for Fatigue Loads: Variable (fatigue) stresses, Stress concentration, Notch sensitivity, and design for fluctuating stresses fatigue failure, Endurance limit, Estimation of endurance strength, Goodman's line, Soderberg's line and Gerber's line, Modified Goodman's Line design of components for finite and infinite life**.**

Concept of Fracture Mechanics - Quasi-Static fracture, Crack modes and stress intensity facture, Fracture toughness.

UNIT III

Design of Bolted Joints: Forms of Screw threads, Stresses in Screw fasteners, Design of bolts with pre-stresses, Design of bolted joints under eccentric loading, Bolts of uniform strength.

Design of Riveted Joints:Types of riveted heads, Riveted joints, Types of failure, Efficiency of joint, Eccentric loading, Design of riveted joints.

UNIT-IV

Design of Mechanical (Cotters and Knuckle) Joints: Spigot and socket, Sleeve and cotter, Jib and cotter joints, Knuckle joint.

Design of Shafts: Shaft design on the basis of strength, Torsional rigidity and lateral rigidity, ASME, Code for shaft design.

UNIT-V

Design of Keys: Sunk, Saddle, Round, Woodruff, Splines, Keyways.

Design of Couplings: Design of rigid couplings- Sleeve or muff, Split-muff or compression and flange couplings, Design of flexible couplings- Bushed pin type flange coupling.

TEXT BOOKS

1. C.S. Sharma,*Design of Machine Elements*, Prentice Hall India Learning Private Limited, 2002.
2. V.B. Bhandari, *Design of Machine Elements*, Tata McGraw Hill Publications, 2nd Edition, 2007.
3. Joseph E.Shigely, *Mechanical Engineering Design*, Tata McGraw Hill Publications, 5th Edition, 2006.

SMART BOOK

1. https://www.mhlearnsmart.com/flow/flowswf.html?isbn=9352603427&name=smartbook&product=148767

REFERENCES

1. Sadhu Singh, *Machine Design*, Khanna Publications, 1st Edition, 2019.
2. Pandya and Shah, *Machine Design*, Tata McGraw Hill Publications,20thEdition, 2015.

Data Books

1. Design Data Book by PSG College of Technology.
2. Design Data Handbook for Mechanical Engineering in SI and Metric Units by Balaveera Swamy and Mahadevan.

NOTE: Design data books are permitted in the examinations.

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(18ME0314) MACHINE TOOLS

COURSE OBJECTIVES

The objectives of this course is to

1. *Gain knowledge on working principle of different metal cutting processes.*
2. *Familiarize student with cutting forces andcutting fluids.*
3. *Make the student learn about principles of lathe machines.*
4. *Know about machining processes and its principles of operations.*
5. *Make the student understand about jigs and fixtures and surface finishing operations.*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Describe elements of metal machining.*
2. *Draw Merchant's cycle diagrams.*
3. *Explain the working principle of lathe and different operations performed on it.*
4. *Understands about the drilling, boring, shaping and milling machines.*
5. *Express the basic principles of jigs & fixtures, grinding machines.*
6. *Illustrate numerous surface finishing operations.*

UNIT-I

Introduction of Metal Cutting Theory – Basic Elements of cutting, Methods of metal cutting – Classification of cutting tools – Geometry of single point tool and angles, chip formation and types of chips – Built up edge and its effects, Chip breakers.

UNIT-II

Cutting Force Analysis- Mechanics of orthogonal cutting-Merchant's Force diagram, cutting forces – cutting speeds, feed, depth of cut, tool life, coolants. Cutting Tool materials and cutting fluids – types and characteristics.

UNIT-III

Engine lathe – Principle of working- specification of lathe – types of lathes – work holders and tool holders –Taper turning, thread turning and attachments for Lathes.

Turret and capstanlathes – Collet chucks – Other work holders – Tool holding devices – Box tools layout. Principle features of automatic lathes – Classification – Single spindle and multi- spindle automatic lathes.

UNIT-IV

Drilling and Boring machines – Principles of working, specifications, types, operations performed – Tool holding devices – Twist drill – Boring tools – Machining time calculation.

Shaping, Slotting and planning machines –Principles of working – Principal parts – specification, classification, Operations performed.

Milling machine – Principles of working – Specifications – Classifications of milling machines – Principal features – Machining operations, Types and geometry of milling cutters– methods of indexing – Accessories to millingmachines.

UNIT-V

Grinding machine –Theory of grinding – Classification– Cylindrical and surface grinding machine – Tool and cutter grinding machine – Special types of grinding machines – Grinding wheel: Different types of abrasives – bonds, specification and selection of a grinding wheel

Lapping, Honing and Broaching machines – Comparison of grinding, lapping and honing and types of broaching machines.

Jigs and fixtures-Principles of design and uses, Classification – Principles of location and clamping – Types of clamping & work holding devices, typical examples of Jigs and fixtures

TEXT BOOKS

1. B.S.RaghuVamshi,*Workshop Technology – Vol II*, DhanpatRai& Co, 9th Edition, 2013.
2. R.K. Jain and S.C. Gupta, *Production Technology,* Khanna Publishers, 17th Edition, 2012.

REFERENCES

1. S.K. HajraChowdary, *Elements ofWorkshop Technology Vol II,* Media promoters & publishers Pvt. Ltd, 13thEdition, 2010.
2. Kalpakzian, *Manufacturing Technology*, Pearson education India, 5th Edition, 2009.
3. Milton C.Shaw, *Metal cutting Principles*, oxford Second Edition, 2nd Edition,2012.
4. K.L.Narayana, *Production Technology*, IK International Publishing house Pvt Ltd 3rd Revised Edition 2014.

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(18ME0315) THERMAL ENGINEERING

COURSE OBJECTIVES

The objective of this course is to

1. *Impart brief knowledge on I.C Engines.*
2. *Familiarize student with Air compressors and its classification.*
3. *Make the student learn about Vapour power cycles and methods of improving cycle performance.*
4. *Enable the student to know about the Steam nozzles and condensers.*
5. *Understand about Steam turbines, classification & its Governing.*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Interpret the knowledge of I C engines in Engine performance calculations*
2. *Compute various performance parameters of an I Cengine.*
3. *Summarize the working of Air compressors and its classification.*
4. *Analyze Vapour power cycles and can find methods to improve cycle performance.*
5. *Recognize the importance of Steam nozzles and Condensers in steam power plants.*
6. *Describe the phenomenon of Governing in Steam turbines, Classification & its Governing and can compute efficiency of steam turbine.*

UNIT-I

I.C. Engines- Definition of Engine and Heat Engine, I.C Engine Classification–Parts of an IC Engine, Working of Two Stroke & Four Stroke Engines, Valve and Port Timing Diagrams.

Testing and Performance – Performance Parameters - Measurement of Fuel Consumption, Air Intake, Exhaust Gas Composition, Brake Power – Indicated Power – Friction power– Heat Balance Sheet.

UNIT-II

Air Compressors- Classification of Compressors-Reciprocating Compressors,Single Stage Reciprocating Compressors, Effect of Clearance volume in Compressors, Volumetric Efficiency, Multi Stage Compressors, Effect of Inter cooling in Multi - Stage Compressors-Problems.

Rotary Compressors-Working principles of Roots blower, Vane type Blower, Centrifugal Compressor - Axial Flow Compressors.

UNIT-III

Vapour Power Cycle- Rankine cycle-Schematic Layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat Addition, Rankine cycle Efficiency, Problems on simple Rankine cycle.

Methods of improving cycle performance-Regeneration, Reheat, Problems on Reheat and Regenerative cycle.

UNIT-IV

Steam Nozzles and Condenser- Expansion of steam through nozzle, Types of nozzles, Condition for maximum discharge, Critical pressure ratio, Effect of friction, Super saturated flow, Degree of Super Saturation and Degree of under Cooling, Problems on Steam Nozzles.

Condensers- Types of Condensers- Mixing and Non Mixing Type of Condensers.

UNIT-V

Steam Turbines - Principles of impulse and reaction turbines, Compounding of Steam Turbines, Velocity diagrams for single & multistage turbines, Work done on turbine blades & efficiencies, Losses in steam turbines.

Governing of steam turbines - Need for Governing - Types of Governing of Steam turbines.

TEXT BOOKS

1. R.K.Rajput, *Thermal Engineering*, Laxmi Publications, 6th Edition,2010.
2. V. Ganesan, *Internal Combustion Engines*, McGraw Hill Education, 4th Edition, 2012.

REFERENCES

1. R.YADAV, *Steam & Gas Turbines and Power plant Engineering*, Central Publishing House, 1st Edition,1996.
2. Sadhu Singh &SukumarPati, *Thermal Engineering*, Pearson Publications, 2nd Edition, 2018.
3. P.W Gill. J.H Smith & E.J Ziurgs, *Fundamentals of I.C Engines*, Oxford& I B HPublication, ist Edition,1990
4. P.L Ballaney, *Thermal Engineering*, Khanna Publication, 15thEdition, 2002.

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(18ME0316) COMPUTER AIDED MODELING LAB

COURSE OBJECTIVES

The objectives of this course is to

1. *Impart brief knowledge on Solid edge software.*
2. *Familiarize student with various commands used to sketch a part.*
3. *Make the student draw various part drawings using solid edge software.*
4. *Learn various assembly commands used to assemble the component.*
5. *Make the student assemble various part drawings of the component.*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Describe the interface of Solid edge software.*
2. *Explain various commands used to sketch a part.*
3. *Understand the use of different commands in Assembly interface.*
4. *Draw various part drawings using solid edge software.*
5. *Summarize various assembly commands used to assemble the component.*
6. *Produce a component by assembling various part drawings of the component.*

List of Experiments

1. Introduction to Solid Edge Software.

2. PART DRAWINGS

a) Modelingof Componentin3D–MACHINE ELEMENTS
b) Modelingof Componentin3D– MACHINE LINK 1
c) Modelingof Componentin3D– MACHINE LINK 2
d) Modelingof Componentin3D–BRACKET
e) Modelingof Componentin3D–DOVETAIL STOP

3. ASSEMBLY DRAWINGS

a) Assembly ofComponentin3D- KNUCKLE JOINT
b) Assemblyof Componentin3D- SCREW JACK
c) Assembly ofComponentin3D- FLANGE COUPLING
d) Assembly ofComponentin3D- UNIVERSAL COUPLING

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L	T	P	C
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(18ME0317) MACHINE TOOLS LAB

COURSE OBJECTIVES

The objectives of this course is to

1. *Impart knowledge on general purpose machine maintenance.*
2. *Provide hands on experience on lathe, drilling, shaping, milling, slotting, grinding and tool and cutter grinding machines.*
3. *Familiarize with different machine tools used in production floor.*
4. *Know about the importance of metal cutting parameters.*
5. *Apply knowledge of basic mathematics to calculate the machining parameters for different machining processes.*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Describe various taper turning methods.*
2. *Demonstrate different machine tools used in machine shop.*
3. *Illustrate knurling, threading and shaping operations on a job.*
4. *Evaluate various fundamental parameters of tool and surface roughness by using different instruments.*
5. *Understands about machine tool structures and machining economics.*
6. *Explain the use of keyway in milling and slotting operations.*

List of Experiments

1. Demonstration of construction & operations of general purpose machines: Lathe, Drilling machine, Milling machine, Shaper, Planning machine, slotting machine, Cylindrical Grinder, Surface grinder and Tool & cutter grinder.
2. Job on Step turning and taper turning on lathe machine.
3. Job on Thread cutting and knurling on lathe machine.
4. Job on Drilling and Tapping
5. Job on Shaping
6. Job on Slotting
7. Job on Milling (groove cutting/ gear cutting)
8. Job on Cylindrical and Surface Grinding
9. Job on Grinding of Tool angles.

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(18ME0318) THERMAL ENGINEERING LAB

COURSE OBJECTIVES

The objectives of this course is to

1. *Impart knowledge on Maintenance of a two wheeler.*
2. *Make the student learn about tire changing, injector testing, Wheel alignment & Balancing, Disc Braking of a four wheeler.*
3. *Enable the student to draw valve timing & port timing diagram of an engine.*
4. *Make the student to conduct performance test on 4 -Stroke Diesel Engine & VCR Petrol Engine.*
5. *Impart knowledge in conducting Heat Balance test on a 4 -Stroke Diesel Engine.*

COURSE OUTCOMES

On successful completion of the course, the students will be able

1. *Describe the Maintenance of Air filter, Spark plug and carburetor of a two wheeler.*
2. *Understands about suspension systems, Chain Overhauling and dismantling brakes of a two wheeler.*
3. *Explains about tire changing, injector testing, Wheel alignment & Balancing, Disc Braking of a four wheeler.*
4. *Construct valve timing & Port timing diagram of an engine.*
5. *Estimate the performance of 4 -Stroke Diesel Engine & VCR Petrol Engine.*
6. *Execute Heat Balance test on a 4 -Stroke Diesel Engine.*

List of Experiments

1 a. Valve Timing Diagram of an I.C. Engine.

b. Port Timing Diagram of an I.C. Engine.

2. Performance Test on a 4 -Stroke Diesel Engine.

3. Heat Balance test on a 4 -Stroke Diesel Engine.

4. Performance Test on VCR Petrol Engine.

5. Maintenance of air filter & Carburetor.

6. Experiment on Spark plug cleaning and testing & Chain Overhauling.

7. Experiment on removal of brake & its fitments.

8. Experiment on Engine oil Replacement and Brake overhauling.

9. Study Experiment on Suspension Systems.

10. Experiment on Ultrasonic injector testing & Maintenance.

11. Experiment on Wheel Balancing & Wheel Alignment.

12. Experiment on Replacing tire of a four wheeler.

13. Study experiment on Disc Braking.

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(18HS0842) APTITUDE PRACTICES

COURSE OBJECTIVES

The objectives of this course

1. *To evaluate various real life situations by resorting to Analysis of key issues and factors.*
2. *To read between the lines and understand various language structures.*
3. *To demonstrate various principles involved in solving Mathematical problems and thereby reducing the time taken for performing job functions.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Develop the subtle way of approaching in the candidate.*
2. *Acquired the decision making with in no time.*
3. *Implement logical thinking during professional tenure.*
4. *Improve knowledge on problem solving.*
5. *Understand problems on coding and decoding.*
6. *Apply the knowledge on the concept of reasoning in real life.*

UNIT – I

Percentages, Partnership, Ratio and Proportion**,** Time and Distance, Time and Work.

UNIT – II

Clocks, Calendars, Blood relations, Profit and Loss, Simple Interest, Compound Interest.

UNIT – III

Permutations and Combinations, Probability**.**

Menstruation: Areas, Volumes of different solids, Problems on Areas, Volumes and Surface Areas, Cubes.

UNIT – IV

Number and letter series:

Difference series, Product series, Squares series, Cubes series, Alternate series, Combination series, miscellaneous series, and Place values of letters.

Number and Letter Analogies:

Definition of Analogy, Problems on number analogy.

Odd man out:

Problems on number Odd man out, Problems on letter Odd man out, Problems on verbal Odd man out.

UNIT – V

Coding and decoding, Directions.

Critical Reasoning: Problems on assumption, Problems on conclusions, Problems on inferences, Problems on strengthening and weakening of arguments, Problems on principle, Problems on paradox.

TEXT BOOKS

1. Barrons GL, *Thorpe's verbal reasoning*, McGraw Hills, LSAT Materials, 2010.
2. Agarwal R S, *A modern approach to Logical reasoning*, S. Chand, 2017.

REFERENCES

1. Agarwal R S, *Quantitative Aptitude*, S Chand, 2017.
2. BARRONS G L, *Quantitative Aptitude*, 2010.
3. AbhijitGuha, *Quantitative Aptitude*, PHI Learning PVT. LTD, 2019.
4. Tyra, *Magical Book on Quicker Maths*, BSC publishing company, 2018.

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(18ME0319) DESIGN OF MACHINE ELEMENTS-II

COURSE OBJECTIVES

The objectives of the course is to

1. *Understand various elements involved in a mechanical system.*
2. *Study selection of rolling element bearing and design of hydrodynamic bearing.*
3. *Analyze various forces acting on the elements of a mechanical system and design them using appropriate techniques, codes, and standards.*
4. *Produce assembly and working drawings of various mechanical systems involving machine elements like gears, springs etc.*
5. *Select transmission elements like gears, belts, pulleys, bearings from the manufacturers' catalogue.*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Summarize the knowledge to design crane hooks, C-clamps and various belt, rope and chain drives.*
2. *Design and analyze journal bearings, ball bearings and roller bearings and Explain the advantages of rolling contact bearings against sliding contact bearings.*
3. *Apply the concepts to know various forces acting on I C engine parts and failure criteria to be adopted for various parts.*
4. *Create helical sprigs for two wheel vehicle and laminated springs for trucks.*
5. *Explain Gears and its classification.*
6. *Design spur and helical gears for different input conditions.*

UNIT-I

Design of Curved Beams: Introduction, stresses in curved beams, Expression for radius of neutral axis for rectangular, circular and T-Section, Design of crane hooks, C –clamps**.**

Design of Power Transmissions Systems- Design of Flat belt drives, V-belt drives & rope drives. Selection of wire ropes. Design of chain drives

UNIT-II

Design of sliding contact Bearings: Types of bearings, Lubrication, Bearing Modulus, bearing materials, journal bearing Design

Design of rolling contact bearing: Design of Ball and roller bearings, Static loading of ball & roller bearings, bearing life, Failure of bearings, Design for variable loading.

UNIT-III

Design of IC Engine Parts: Pistons– Construction, Design of piston. Cylinder, Cylinder block Connecting Rod, Cranks and Crank shafts- Centre and over hung cranks.

UNIT-IV

Design of Mechanical Springs– Types of springs, Stress and deflections of helical springs, coaxial springs, Energy storage capacity- Design of Helical Torsion springs, Design of Leaf springs

UNIT-V

Design of Gears: Introduction, Classification of Gears- Spur, Helical, Bevel and Worm Gears. **Spur & Helical Gears** –Force Analysis, Load concentration factor, Dynamic load factor, Surface compressive strength, Bending strength, Design analysis of spur gears, Estimation of center distance, module and face width, check for plastic deformation, Check for dynamic and wear considerations.

TEXT BOOKS

1. R.S. Kurmi and J.K. Gupta, *Machine Design*, S. Chand Publications, 1st Multi color Edition, 2005.
2. V.B. Bhandari, *Design of Machine Elements*, Tata McGraw Hill Publications, 2nd Edition, 2007.
3. Joseph E. Shigely, *Mechanical Engineering Design*, Tata McGraw Hill Publications, 5th Edition, 2006.

SMART BOOK

1. https://www.mhlearnsmart.com/flow/flowswf.html?isbn=9352603427&name=smart_book &product=148767

REFERENCES

1. Sadhu Singh, *Machine Design*, Khanna Publications, 1st Edition, 2019.
2. Dr. G. K. Vijayaraghavan & Dr. S. Vishnupriyan, *Design of Machine Elements*, Laxmi Publications, 6th Edition, 2015.
3. C.S. Sharma, *Design of Machine Elements*, PHI Learning Pvt. Ltd., 1st Edition, 2002.

Data Books:

1. Design Data Book by PSG College of Technology.
2. Design Data Handbook for Mechanical Engineering in SI and Metric Units by Balaveera Swamy and Mahadevan.

NOTE: *Design data books are permitted in the examinations.*

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(18ME0320) HEAT & MASS TRANSFER

COURSE OBJECTIVES

The objectives of the course is to

1. *Explain the mechanisms of basic modes of heat transfer and conduction.*
2. *Elucidate the Mechanisms of heat transfer under steady and transient conditions.*
3. *Describe the principles and applications of Forced and free convection.*
4. *Estimate the thermal analysis and sizing of heat exchangers.*
5. *Illustrate the basic concepts of Radiation and mass transfer.*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Explain the fundamental principles associated with heat transfer.*
2. *Evaluate multi-dimensional and transient thermal conduction problems.*
3. *Analyze forced convection, internal flows and free convection problems.*
4. *Understands about Boiling and Condensation.*
5. *Design heat exchangers for various applications.*
6. *Illustrate the principles of radiation and mass transfer.*

UNIT – I

Basic Concepts: Modes of Heat Transfer –Conduction - Fourier Law of Conduction Heat transfer by convection and radiation - General Differential equation of Heat Conduction for Cartesian coordinates, cylindrical coordinates and spherical coordinates.

UNIT – II

One Dimensional Steady State Heat Conduction: Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems –Critical radius of insulation.
Extended Surfaces: Types of Fins, Effectiveness and Efficiency of Fins
Transient Heat conduction: Heat conduction in solids-Lumped Parameter Analysis Infinite, solids with finite, semi-infinite solids.

UNIT – III

Free Convection: Empirical correlation of free convection, Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Horizontal cylinders and Spheres.
Forced Convection: Laminar flow over a flat plate, Boundary layer definition and characteristics - Empirical correlations for forced convection -External Flow – Flow over Cylinders Spheres and Bank of tubes

UNIT – IV

Phase Change Heat Transfer and Heat Exchangers
Boiling: Types General aspects, Boiling Regimes – Factors affecting nucleate boiling- Boiling correlations.
Condensation: Drop wise and film wise condensation -Laminar film condensation on a vertical plate, correlations in condensation.

Heat Exchanger: Types of Heat Exchangers- LMTD method - Overall Heat Transfer Coefficient – Fouling Factors – Heat Exchanger Effectiveness-NTU Method

UNIT – V

Radiation: Introduction, Surface emissive properties - Absorptivity, Reflectivity and Transmissivity, Concept of a black body. Laws of Radiation – Stefan Boltzmann Law,Kirchhoff's Law, Plank's Law, Wiens Displacement Law.

Mass Transfer- Introduction to Mass transfer - Fick's law – Mass Transfer coefficient – Convective Mass Transfer and its correlations.

TEXTBOOKS

1. R. K. Rajput, *Heat & Mass Transfer*, S. Chand publishers, 5th Revised Edition, 2012.
2. P.K. Nag, *Heat and Mass Transfer*, Tata McGraw Hill, 3rd Edition, 2011.

REFERENCES

1. Kothandaraman, C. P, *Fundamentals of Heat and Mass* Transfer, New Age International (P) Ltd., 4thEdition, 1998.
2. Sachdeva R.C, *Fundamentals of Heat and Mass Transfer,* New Age International (P) Ltd., 4thEdition,2012.
3. Yunus A. Cengel, *Heat Transfer A Practical Approach*, Tata McGraw Hill, 5th Edition, 2004.

NOTE: *HMT data books are permitted in the examinations.*

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(18ME0321) METROLOGY & MEASUREMENTS

COURSE OBJECTIVES

The objectives of the course is to

1. *Use of slip gauges, system of limits, fits &tolerances and design of gauges.*
2. *Identify the use of Comparators (Mechanical, Optical, and Electrical & Pneumatic), Sine bar, Interferometer, and measurement of Screw threads & Gear tooth parameters.*
3. *Know the measurement of screw thread, Gear, and alignment of machine tools.*
4. *Measurement of Displacement, Speed and Stress- Strain.*
5. *Illustrate the measuring process of Pressure, Force, Torque, and Temperature& Power.*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Explain the basic standards of measurements and also application of Slip gauges.*
2. *Describe the concept of different types of dimensional tolerances and fits.*
3. *Evaluate engineering parts with various precision instruments.*
4. *Check the surface roughness of parts.*
5. *List out various measuring techniques for Pressure, Strain and Temperature.*
6. *Estimate the Instruments accuracy and Perform calibration of measuring instruments*.

UNIT-I

Limits, Fits & **Toleranc**es: Introduction, Definitions of limits and tolerances– unilateral and bilateral tolerance system, Fits and their types, Hole and Shaft basis systems – Interchangeability and selective assembly, Indian standard system– International Standard Organization system for plain work.
Limit Gauges and Gauge Design: Plug Ring, Snap, Gap, Taper gauges. Taylor‘s principle.

UNIT-II

Linear Measurement: Calibration of Slip gauges, Vernier gauges, Dial indicator, Micrometers.
Measurement of Angles and Tapers: Different methods – Bevel protractor – Angle gauges – Spirit level – sine bar, rollers and spheres used to determine the tapers.
Surface Measurement: Surface roughness, Surface waviness- Assessment of surface finish – CLA, R.M.S Values – Ra , Rz values, BIS symbols for indication of surface finish, Profile graph, Talysurf, Auto collimators.

UNIT-III

Screw Thread Measurement: Elements – Errors In Screw Threads – Measurement Of diameters, angle of thread and thread pitch, Toolmaker’s microscope.
Gear Measurement: Elements -Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch, tooth thickness.
Machine Tool Alignment Tests: Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling and drilling machine tools.

UNIT-IV

Measurement of Displacement: Theory and construction of various transducers to measure displacement - Piezoelectric, Inductive, capacitance, resistance, ionization and Photo electric transducers.

Measurement of Speed: Mechanical Tachometers - Electrical tachometers - Stroboscope, Noncontact type of tachometer.

Stress & Strain Measurements: Various types - Electrical strain gauge - method of usage of Resistance strain gauge for bending, compressive and tensile strains - usage for measuring Torque, Strain gauge rosettes.

Recent Developments In Instrumentation And Measurements: Micro sensors, Smart sensors, Smart transmitters and Field bus, Virtual instrumentation

UNIT-V

Measurement of Temperature: Standards and calibration of thermal expansion methods, thermo electric sensors (thermocouples), Electrical Resistance sensors, Digital thermometers.

Measurement of Pressure: Standards and Calibration - Basic methods of pressure measurement, Dead weight gauges and Manometers.

Measurement of Force, Torque, Power: Standards and calibration, Basic methods of Force Measurement, Torque measurement on rotating shafts, Shaft power measurement (dynamometers).

TEXTBOOKS

1. M. Mahajan ,*Engineering Metrology***,** Dhanpat Rai publisher, 2nd Edition, 2013.
2. R.K. Jain , *Engineering Metrology*, Khanna Publishers, 20th Edition, 2013.

REFERENCES

1. Thomas G. Beckwith, Roy D. Marangoni, *Mechanical Measurements*, John H. Lien hard V, Pearson Publisher, 6th Edition, 2006.
2. Earnest. O Doeblin, *Measurement systems Application and design*, McGraw Hill Higher Education, 4th Revised Edition, 1990.

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B.Tech – M.E

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(18ME0330) INDUSTRIAL ENGINEERING & MANAGEMENT

COURSE OBJECTIVES

The objectives of the course is to

1. *Familiarize with concepts of Management, Administration and Organization.*
2. *Learns the concepts of plant layout, production system.*
3. *Understands the basic concepts of work study, work measurements and quality control.*
4. *Know the importance of inventory and ERP systems.*
5. *Recognize the need of human resource department function and objectives.*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Interpret the roles and responsibilities of Management-Administration and Organization.*
2. *Explain about organizational structures with its merits and demerits*
3. *Assess the type of plant layout for increasing productivity*
4. *Describe the importance of work and time study at work place*
5. *Recognize the importance of inventory and ERP systems.*
6. *Describe the human resource department effectiveness and ability to lead an organization.*

UNIT-I

Concepts of Management-Administration and Organization – Functions of Management –Schools of Management Thought: Taylor‘s Scientific Management, Fayol‘s Principles of Management, Douglas McGregor‘s Theory X and Y, Hertzberg‘s Two factor Theory of Motivation, Maslow‘s Hierarchy of Human needs –Systems Approach to Management.

Organizational Structures - Principles, Classification- Scalar, Line and Staff and Functional Organization – Departmentation and Decentralization with Merits, and Demerits.

UNIT-II

Plant Location: Factors affecting the Plant Location, Comparison of Rural and Urban sites, Methods for Selection of Plant – Schemes offered by Government for rural Entrepreneurs

Plant Layout: Definition, Objectives, Types – Process and Product Layout – Various Data Analyzing Forms – Travel Chart, Process Chart, Diagrams, Templates, Models, REL chart –Computer techniques for Optimization of Plant Layout -Material Handling Systems- Types-Selection Criteria.

UNIT-III

Work Study and Method Study – Definition, Objectives and Steps Involved – Method study symbols-Recording Techniques - Types of Charts and diagrams – Micro motion and Memo motion Studies.

Work Measurement - Definition, Objectives, Work measurement Techniques - Time Study, -Steps involved -Performance Rating- Allowances - Standard Time Calculation - Work Sampling -Definition, Procedure – Applications

UNIT-IV

Managerial Economics –Introduction - Demand Analysis- Elasticity of Demand- Demand forecasting- factors governing demand Forecasting- Methods of demand forecasting –Cost Concept of Break-Even Analysis (BEA)

Marketing- Types of Markets - Perfect and Imperfect Competition – Features- Price-Output determination - Pricing Methods and Strategies.

UNIT-V

Capital and Capital Budgeting - Need – Methods and Evaluation of Capital budgeting – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method.

Financial Accounting and Analysis - Journal - Ledger – Trial Balance - Financial Statements - - Trading Account – Profit & Loss Account –Balance Sheet (with simple adjustments).

TEXT BOOKS

1. O. P. Khanna, *Industrial Engineering and Management*, DhanpatiRai, 18th Edition, 2013.
2. A R. Aryasri, *Managerial Economics and Financial Analysis*, TMH, 2nd Edition, 2018.
3. R L Varshney & K L Maheswari, *Managerial Economics*, Sultan Chand& Sons, 22nd Edition,2014.

REFERENCES

1. Martind Telsang, *Industrial Engineering and production management*, S. Chand, 12th Edition, 2018.
2. Dr. C. Nadamuni Reddy, *Industrial Engineering and Management*, New Age International Publishers, 4thEdition, 2011.
3. S.A. Siddiqui and A.S. Siddiqui, *Managerial Economics and Financial Analysis*, New Age International,.4th Edition, 2009.

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(18ME0331) PRODUCTION & OPERATIONS MANAGEMENT

COURSE OBJECTIVES

The objective of the course is to

1. *Understand about the production planning & control and new product design & development.*
2. *Learn the concept of forecasting, its types and techniques.*
3. *Familiarize with Techniques of location, facility planning and latest computerized layouts.*
4. *Know about the Strategies of aggregate planning and Inventory Management.*
5. *Learn Scheduling policies and concept of lean management.*

COURSE OUTCOMES

On successful Completion of this course the student will be able to

1. *Explain the Functions of production planning & control operation and productivity measurement.*
2. *Develop new products and its design issues.*
3. *Describe the Importance of forecasting, uses, principles and its methods.*
4. *Analyze and evaluate various facility alternatives and their capacity decision.*
5. *List out Aggregate planning strategies and Inventory management and control.*
6. *Summarize Scheduling policies, lot sizing techniques and implementation of suitable quality control measures in operation environments.*

UNIT-I

Introduction - Production Planning & Control- Functions - Operations & productivity, productivity measurement, Design of goods and services: selection, generating new products, product development, issues in product design.

UNIT-II

Forecasting – Importance of forecasting – Types of forecasting, their uses – General Principles of forecasting – Forecasting techniques – Qualitative methods and Quantitative methods

UNIT-III

Plant Layout: Factors affecting facilities location, mathematical models for facilities, location, Types of facilities-layout: product layout, process layout, group technology layout, Assembly line balancing, computerized layout: ALDEP, CRAFT, and CORELAP (Only Basics).

UNIT-IV

Production Planning Strategies: Strategies for aggregates planning, chase planning, expediting, controlling aspects.

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis –VED analysis – EOQ model – Inventory control systems – P–Systems and Q-Systems-(S, s) Policy

UNIT-V

Scheduling Policies – Techniques, flow shop and job shop scheduling techniques. MRP – Lot sizing techniques in MRP, introduction to ERP, Line of Balance (LOB).

Lean Management- philosophy and creation of lean enterprise, JIT concepts - Kanban System, Elements of total quality management, Six Sigma Quality Control

TEXT BOOKS

1. R Panneerselvam, *Production and Operation management*, PHI Learning Private Limited, 3rd Edition, 2012.
2. Elwood Baffa & RakeshSarin, *Modern Production/Operations Management*, Wiley India Private Limited, 8th Edition, 2009.

REFERENCES

1. S.N. Chary, *Production and Operations Management*, Tata McGraw Hill Education Private Limited, 5th Edition, 2012.
2. R B Khanna, *Production and Operation Management*, PHI Learning Private Limited, 2nd Edition, 2015.
3. S.N. Chary, *Operations Management*, McGraw Hill Higher Education, 3rd Edition, 2006.
4. Franklin G. Moore, *Production Control*, McGraw Hill Text publisher, 3rd Edition, 1969.

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(18ME0332) TOTAL QUALITY MANAGEMENT

COURSE OBJECTIVES

The objective of the course is to

1. *Know the importance of the quality, costs of quality, and Basics concepts of quality.*
2. *Learn TQM principles, employee involvement, team spirit and PDCA cycle.*
3. *Familiarize with the management tools like Six Sigma, Bench Marking.*
4. *Know TQM tools like control charts , QFD, Taguchi loss function and TPM.*
5. *Understand the tools and techniques of quality management to manufacturing and services processes.*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Understand the importance of the quality, costs of quality, and Basics concepts of quality.*
2. *Describe the TQM principles, employee involvement, and team spirit and PDCA cycle.*
3. *Explain the management tools like Six Sigma, Bench Marking.*
4. *Recognize various stages of FMEA and its classification.*
5. *Summarize TQM tools like control charts, QFD, Taguchi loss function and TPM.*
6. *Apply the tools and techniques of quality management to manufacturing and services processes.*

UNIT-I

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, and Customer retention - Costs of quality.

UNIT-II

TQM Principles - Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT-III

TQM Tools And Techniques I - The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT-IV

TQM Tools And Techniques II - Control Charts - Process Capability - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT-V

Quality Systems - Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing -QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors.

Statistical Quality Control- Techniques-Variables and Attributes- Control Charts: X and R Charts; P Charts and C Charts. Acceptance Sampling Plan - Single Sampling and Double Sampling Plans- OC Curves.

TEXT BOOKS

1. Dale H. Besterfiled, et at., *Total quality Management*, 3rd Edition, Pearson Education Asia, Indian Reprint, 2006.
2. James R. Evans and William M. Lindsay, *the Management and Control of Quality*, 8thEdition.

REFERENCES

1. Joel E. Ross, Susan Perry, *Total Quality Management Text, Cases, and Readings*, RoutledgePublications,3rd Edition, 2014
2. Suganthi. L and Anand Samuel, *Total Quality Management*, Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal .R.K., *Total Quality Management - Text and Cases*, Prentice Hall (India) Pvt. Ltd., 8thEdition, 2006.
4. D. R. Kiran, *Total Quality Management: An integrated approach*, BS Publications, 2016.

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(18CE0127) ELEMENTS OF ROAD TRAFFIC SAFETY

COURSE OBJECTIVES

The objectives of this course is to

1. *To understand the accident statistics globally and in India specifically, its causes and measures to overcome the situation.*
2. *The traffic regulation, parking problems, understanding of road signs, signals and marking are also taught; so that the student is well informed about all safety measures that a traffic engineer need to understand.*
3. *To understand the various aspects of street lighting.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Identify the causes for road accidents and can implement measures to prevent road accidents.*
2. *Describe traffic regulations and implement parking methods.*
3. *Classify different traffic signal and can design traffic signal system.*
4. *List out and illustrate various traffic signs.*
5. *List out and discuss various road markings.*
6. *Discuss importance of street lighting and classify various street lighting system.*

UNIT – I

Road Accidents – Causes & Prevention: Road Accidents & Traffic Engineering – Accident Situation in India – International Comparison of Road Accidents – Road & its Effects on Accidents – The Vehicle – The Driven – Skidding – Speed in Relation of Safety – Weather & its Effects on Accidents – Pedestrian Safety - Cyclists – Motor Cycle & Scooter Rider – Parking & Its Influence on Accident – Legislation, Enforcement, Education & Propaganda – Cost of Road Accidents.

UNIT – II

Regulations of Traffic: Basic Principals of Regulation – Regulation of Speed – Regulation of Vehicles – Regulations Concerning the Driver – Regulations Concerning Traffic – Parking Regulations – Enforcement of Regulations.

Parking: Traffic & Parking Problems – Ill-Effects of Parking – Zoning & Parking Space Requirement Standards – Design Standards for On-Street Parking Facilities – Traffic Regulatory Measures for On-Street Parking – Off-Street Parking Facilities – Peripheral Parking Schemes – Loading & Unloading Facilities – Truck Terminals – Long Distance Bus Terminals.

UNIT – III

Traffic Signs: Importance of Traffic Signs – Need for International Standardization – The Situation in India – General Principals of Traffic Signing – Types of Traffic Signs – Danger Signs (Warning Signs or Cautionary Signs) – Prohibitory Signs – Mandatory Signs – Informatory Sings – Indication Signs – Direction Signs, Advance Direction Signs & Place Identification Signs – Overhead Sings – Route Marker Sings – Location, Height & Maintenance of Traffic Sings.

UNIT – IV

Traffic Signals: Advantages & Disadvantages of Traffic Signals – Signal Indications – Signal Face – Illustration of the Signals – Number & Location of Signals Faces – Amber Period, Red/Amber Period & Inter Green Period – Fixed Time Signals & Vehicle Actuated Signals – Determination of Optimum Cycle Length & Signal Settings for an Intersection with Fixed Time Signals – Warrants for Signals – Co-ordinated Control of Signals – Signal Approach Dimensions – Area Traffic Control – Delay at Signalized Intersection.

UNIT – V

Road Markings: Function – Types of Road Marking – General Principals of Longitudinal Pavement Markings – Material & Color – Centre Lines – Traffic Lane Lines – No Overtaking Zone Markings – Pavement Edge Lines – Carriageway Width Reduction Transition Marking – Obstruction Approach Markings – Stop Lines – Pedestrian Crossings – Cyclist Crossings – Route Direction Arrows – Word Messages – Markings at Approaches to Intersections – Parking Space Limits – Object Markings.

Street Lighting: Need for Street Lighting – Definition of Common Terms – Some Laws of Illumination – Mounting Height – Spacing – Lantern Arrangements – Type of Lamps – Lamp Installation of T' Junctions & Cross Roads – Illumination of Traffic Rotaries – Lighting of Bends – Lighting of Dual Carriageways – Lighting of Roads Carrying Only Local Traffic – Lighting Bridges – Tunnel Lighting – Maintenance of Lighting Installation.

TEXT BOOKS

1. L.R. Kadiyali and Lal, *Traffic Engineering and Transportation Planning*, Khanna Publications, 9th Edition, 1999.
2. S.K. Khanna&C.E.G.Justo, *Highway Engineering*, Published by Nemchand & Bros, 10thEdition, 2012.

REFERENCES

1. L.R. Kadiyali and Lal, *Principles and Practice of Highway Engineering Design*, Khanna Publications, 7th Edition, 2013.
2. R. Srinivasa Kumar, *Text book of Highway Engineering*, Universities Press.
3. James H Banks, *Introduction to Transportation Engineering*, Tata McGraw hill Publications, 2nd Edition.

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(18EE0234) INDUSTRIAL INSTRUMENTATION

COURSE OBJECTIVES

The objectives of this course are:

1. *To Analyze the Common errors that occurring measurement systems, and their classification*.
2. *To understand the characteristics of signals, their representation, and signal modulation techniques*.
3. *To learn the Methods of Data Transmission, Telemetry, and Data acquisition.*
4. *To study working principles of different Signal Analyzers and Digital meters.*
5. *To learn about several types of transducers and their use for measurement of non-electrical quantities.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Identify and explain the types of errors occurring in measurement systems.*
2. *Differentiate among the types of data transmission and modulation techniques.*
3. *Apply digital techniques to measure voltage, frequency and speed*.
4. *Analyze the working principles of different Signal Analyzers and Digital meters.*
5. *Understand the operation of several types of transducers.*
6. *Choose suitable Transducers for the measurement of non-electrical quantities.*

UNIT-I

Characteristics of Signals and Their Representation: Measuring Systems, Performance Characteristics, Static Characteristics, Dynamic Characteristics; Errors in Measurement Gross Errors, Systematic Errors, Statistical Analysis of Random Errors. Signals and their Representation: Standard Test, Periodic, Aperiodic, Modulated Signal, Sampled Data, Pulse Modulation and Pulse Code Modulation.

UNIT-II

Data Transmission, Telemetry and DAS: Methods of Data Transmission General Telemetry System. Frequency Modulation (FM), Pulse Modulation (PM), Pulse Amplitude Modulation (PAM), Pulse Code Modulation (PCM) Telemetry. Comparison of FM, PM, PAM and PCM. Analog and Digital Data Acquisition Systems–Components of Analog DAS– Types of **Multiplexing Systems:** Time Division and Frequency Division, Multiplexing–Digital DAS – Block Diagram — Modern Digital DAS (Block Diagram)

UNIT-III

Signal Analyzers, Digital Meters: Wave Analyzers – Frequency Selective Analyzers, Heterodyne, Application of Wave Analyzers-Harmonic Analyzers, Total Harmonic Distortion, Spectrum Analyzers, Basic Spectrum Analyzers, Spectral Displays, Vector Impedance Meter, Q Meter. Peak Reading and RMS Voltmeters, Digital Voltmeters – Successive Approximation, Ramp and Integrating Type – Digital Frequency Meter-Digital Multimeter – Digital Tachometer

UNIT-IV

Transducers: Definition of Transducers, Classification of Transducers, Advantages of Electrical Transducers, Characteristics and Choice of Transducers; Principle of Operation of Resistive, Inductive, Capacitive Transducers, LVDT, Strain Gauge and its Principle of Operation, Gauge Factor, Thermistors, Thermocouples, Synchros, Piezoelectric Transducers, Photovoltaic, Photo Conductive Cells, Photo Diodes.

UNIT-V

Measurement of Non – Electrical Quantities: Measurement of strain, Gauge Sensitivity, Measurement of Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Flow, Liquid level.

TEXT BOOKS

1. A.K. Sawhney, *A course in Electrical and Electronic Measurements and Instrumentation*, Dhanpat Rai & Co., 2012.
2. D.V.S. Murty, *Transducers and Instrumentation*, Prentice Hall of India, 2nd Edition, 2004.

REFERENCES

1. A. Dhelfrick and W.D. Cooper, *Modern Electronic Instrumentation and Measurement technique*, Pearson/Prentice Hall of India., 1990.
2. H.S. Kalsi, *Electronic Instrumentation*, Tata MCGraw - Hill Edition, 2010.
3. T.R. Padmanabhan, *Industrial Instrumentation–Principles and Design*, Springer.

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(18EC0449) INTRODUCTION TO IOT

COURSE OBJECTIVES

The objective of the course is to

1. *Provide an overview on the ICT ecosystem and enabling environment to foster Internet of Things (including technology, standards, system management and applications) deployments.*
2. *Define the infrastructure for supporting IoT deployments.*
3. *Provide an understanding of the technologies and the standards relating to the Internet of Things.*
4. *Understand various case studies related to IoT domain.*

COURSE OUTCOMES

On successful completion of this course, student will be able to

1. *Understand the technology and standards relating to IoTs.*
2. *Understand where the IoT concept fits within the broader ICT industry and possible future trends.*
3. *Understand the key components that make up an IoT system.*
4. *Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack.*
5. *Configure Raspberry Pi, Understand Sensors, Actuators & get started with python on Raspberry Pi.*
6. *Apply the knowledge and skills acquired during the course to design, build and test a complete, working IoT system involving prototyping, programming and data analysis.*

UNIT – I

IoT Introduction & Concepts: Introduction to Internet of Things - Physical Design of IoT - Logical Design of IoT - IoT Enabling Technologies - IoT Levels & Deployment Templates.

UNIT – II

Domain Specific IoTs: Home Automation – Cities – Environment – Energy – Retail – Logistics - Agriculture – Industry - Health & Lifestyle.

UNIT – III

IoT and M2M: Introduction – M2M – Difference between IoT an M2M - Software Defined Networking - Network Function Virtualization for IoT.

Developing Internet of Things: IoT Design Methodology – Motivation for using Python

UNIT – IV

IoT Physical Devices & Endpoints: IoT Device – Raspberry Pi Board - Linux on Raspberry Pi – Raspberry Pi Interfaces – Programming raspberry Pi with Python – Other IoT devices.

UNIT – V

Case Studies Illustrating IoT Design: Home Automation – Cities – Environment – Agriculture – Productivity applications.

TEXT BOOKS

1. Vijay Madisetti – Arshdeep Bahga, *Internet of Things a Hands-on Approach*, Arshdeep Bahga & Vijay Madisetti ,1st Edition, 2014.
2. Pethuru Raj and Anupama C. Raman, *The Internet of Things: Enabling Technologies, Platforms, and Use Cases*, CRC Press, 1stEdition, 2014.

REFERENCES

1. Raj Kamal *Embedded Systems*, Tata McGraw-Hill Education, 2ndEdition, 2011.
2. Adrian McEwen & Hakim Classically, *Designing of Internet of Things*, John Wiley and sons Ltd, 1st Edition, 2014,
3. Daniel Kellmereit - Daniel Obodovski, *The Silent Intelligence: The Internet of Things*, DnD Ventures, 1st Edition, 2013.

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(18CS0517) PYTHON PROGRAMMING

COURSE OBJECTIVES

The objective of the course is to

1. *Introduce Scripting Language.*
2. *Exposure to various problem solving approaches of computer science.*
3. *Introduce function-oriented programming paradigm.*
4. *Exposure to solve the problems using object oriented concepts, exceptional handling.*
5. *Exposure to solve the problems using Files, Regular Expressions and, Standard Libraries.*

COURSE OUTCOMES

On successful completion of this course, the student will be able to

1. *Solve the problems using control structures, input and output statements.*
2. *Summarize the features of lists, tuples, dictionaries, strings and files.*
3. *Experience the usage of standard libraries, objects, and modules.*
4. *Solve the problems using Object Oriented Programming Concepts.*
5. *Build the software for real time applications using python.*
6. *Install various Python packages.*

UNIT – I

Introduction: History of Python- Python features- Applications-Programming Using the REPL - Running Python Scripts-Variables – Assignment- Keywords- Input-Output- Indentation.

Data Types: Single-Value data types - int, float, complex and Boolean.

Multi-Valued Data types - Lists, Tuples, Sets, Dictionaries, Strings- indexing and slicing.

UNIT – II

Operators and Expressions: Operators-Arithmetic Operators, Comparison Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators- Expressions and order of evaluations

Control Flow: Branching- simple if, if-else, if-elif-else, nested if, looping-while and for- jumping – break-continue and pass.

UNIT – III

Functions: Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions- Nested functions, Recursive functions- Scope of the Variables in a Function.

Object Oriented Programming in Python: Classes and Objects- self-variable- Methods –Constructor-Inheritance-polymorphism- Method Overloading- Method Overriding.

UNIT – IV

Modules: Creating modules, import statement, from...import statement and name spacing.

Python packages: Introduction to PIP- Installing Packages via PIP (Numpy, Pandas, MatPlotlib etc.,) - Using Python Packages.

Exception Handling: Introduction to Errors and Exceptions, Handing Exceptions, Raising Exceptions, User Defined Exceptions, Regular Expressions-Searching and Matching.

UNIT – V

Functional Programming: Iterators and Generators - Maps and Filters.

Files: Text files- Reading and Writing files- Command line arguments.

Brief Tour of the Standard Library: Dates and Times- Data Compression- Python Runtime Services- Data Management and Object Persistence.

GUI Programming - Turtle Graphics

TEXT BOOKS

1. Reema Thareja, *Python Programming: Using Problem Solving Approach*, 1st Edition, Oxford University Press, 2019.
2. Vamsi Kurama, *Python Programming: A Modern Approach*, Pearson, 2018.

REFERENCES

1. Mark Lutz, *Learning Python*, Orielly.
2. Allen Downey, *Think Python*, Green Tea Press.
3. W. Chun, Core *Python Programming*, Pearson.
4. Kenneth A. Lambert, Introduction *to Python*, Cengage.
5. Michael T. Goodrich , Roberto Tamassia, Michael H. Goldwasser, *Data Structures and Algorithms in Python*, 1st Edition, kindle.

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(18HS0814) INTELLECTUAL PROPERTY RIGHTS

COURSE OBJECTIVES

The objective of the course is to

1. *Provide an understanding of the concept and significance of intellectual property rights.*
2. *Understand the concept of trademarks, copy rights, patents and the need for their protection.*
3. *Comprehend the concept of competition, unfair competition and the latest developments in the laws pertaining to intellectual property rights.*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Become aware of intellectual property rights, concepts, treaties, agencies and international organizations involved in sanctioning IP rights.*
2. *Identify different types of intellectual properties, ownership rights and the scope of the protection.*
3. *Get an adequate knowledge on patents, trademarks, copy rights and to get property rights for their intellectual work.*
4. *Identify, apply, and assess ownership rights, registration processes for IP rights.*
5. *Discern the approaches for intellectual property management and intellectual property audits.*
6. *Demonstrate knowledge and understanding on unfair competition and latest developments in IP rights at international level.*

UNIT-I

Introduction To Intellectual Property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT-II

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

UNIT-III

Law Of Copy Rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law Of Patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT-IV

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Unfair Competition: Misappropriation right of publicity, Falseadvertising.

UNIT-V

New Development Of Intellectual Property: new developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international - trade mark law, copy right law, international patent law, international development in trade secrets law.

TEXT BOOKS

1. Deborah, E. Bouchoux, Intellectual *property right*, cengage learning.
2. Nityananda KV, *Intellectual property rights: Protection and Management*, Cengage Learning India Private Limited.

REFERENCES

1. Prabuddhaganguli, Intellectual *property right - Unleashing the knowledge economy*, Tata McGraw Hill Publishing CompanyLtd.
2. *Law relating to Intellectual Property rights*. India. Ahuja VK IN: Lexis Nexis.
3. Neeraj P &Khushdeep D, *Intellectual Property Rights*, India. PHI learning pvt limited.

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(18ME0322) HEAT TRANSFER LAB

COURSE OBJECTIVES

The objective of the course is to

1. *Define the fundamental concepts to students in the area of heat transfer and its applications.*
2. *Apply the knowledge of heat transfer in an effective manner for different applications.*
3. *Computing thermal conductivity and increased rate of heat transfer with extended surface (Pin Fin).*
4. *Emissivity effect of black body & gray body and Stefan Boltzmann Constant.*
5. *Heat transfer in Drop wise and Film wise Condensation.*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Evaluate thermal conductivity of a given metal Rod and overall heat transfer coefficient for a composite slab.*
2. *Check the increased rate of heat transfer with extended surface (Pin Fin).*
3. *Compare differences in rate of heat transfer between Forced & Natural Convection and also explain the transient heat conduction process.*
4. *Compute rate of heat transfer in Parallel and counter flow heat exchanger.*
5. *Understands emissivity effect of black body & gray body and Stefan Boltzmann Constant.*
6. *Carryout experiment on Heat transfer in Drop wise and Film wise Condensation.*

List of Experiments:

1. Thermal conductivity of insulating powder material through Concentric Sphere apparatus.
2. Thermal conductivity of insulating material through lagged pipe apparatus
3. Thermal Conductivity of metal (conductor).
4. Heat transfer in pin-fin
5. Experiment on Transient Heat Conduction
6. Heat transfer coefficient in natural convection
7. Heat transfer coefficient in forced convection.
8. Experiment on Parallel and Counter flow heat exchanger.
9. Emissivity of a gray body through Emissivity apparatus.
10. Experiment on Stefan Boltzmann Apparatus.
11. Heat transfer in drop and film wise condensation.
12. Study of heat pipe and its demonstration.

Note:

1. Any 10 of the above 12 experiments are to be conducted.
2. Heat Transfer data books are permitted in the examinations

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(18ME0323) METROLOGY AND MEASUREMENTS LAB

COURSE OBJECTIVES

The objective of the course is to

1. *Provide necessary skills for calibrating and testing of different gauges and instruments.*
2. *Define, and explain the terms accuracy &precision*
3. *Identify the sources of variability, error, and uncertainties.*
4. *Learn about Surface Roughness and its measurement.*
5. *Understand about measurement of various parameters using appropriate instruments.*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Understand about Calibration of Linear measuring and Angular measuring instruments.*
2. *Measure Straightness, Flatness and Taper angle.*
3. *Estimate Gear tooth dimensions and thread parameters.*
4. *Compute the various parameters like pressure, displacement, speed, temperature etc., by using various instruments like pressure gauge, LVDT, stroboscope ,thermocouple etc.,*
5. *Check parameters like length, height, angle, displacement, flatness etc., by using various instruments like Vernier calipers, micrometer, dial indicator, etc.*
6. *Find surface roughness using appropriate instruments and analyze the data.*

LIST OF EXPERIMENTS

1. Calibration of linear measuring instruments
2. Calibration of angle measuring instruments
3. Measurement of Taper Angle
4. Measurement of straightness and flatness
5. Measurement of thread parameters
6. Measurements of Gear Tooth Dimensions
7. Calibration of the limits of dimensional tolerances using comparators
8. Measurement of Temperature
9. Measurement of Displacement
10. Measurement of Force
11. Measurement of Torque
12. Measurement of Vibration

Note: Any 10 of the above 12 experiments are to be conducted.

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(18HS0859) ENGLISH FOR CORPORATE COMMUNICATION SKILLS LAB

COURSE OBJECTIVES

The objectives of this course is to

1. *To improve the students' fluency in English, through a well-developed vocabulary*
2. *To enable them listening spoken English at normal conversational speed by English speakers*
3. *To respond appropriately in different social-cultural and professional contexts*
4. *To develop drafting skills among the students.*
5. *To develop Inter-personal and Intra-personal Skills*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Flair in Writing by using cohesion and coherence.*
2. *Prepare effective job application.*
3. *Presenting Effective Speaking Abilities.*
4. *Apply various communicative techniques in their professional lives.*
5. *Cope with the employability skills.*
6. *Use effective communicative approaches by preparing job application, report and other kinds of spoken and written correspondences.*

UNIT – I

COMMUNICATIVE COMPETENCY:

1. Reading Comprehension
2. Listening Comprehension
3. Vocabulary for competitive purpose
4. Spotting Errors

UNIT – II

TECHNICAL WRITING

1. Report writing
2. Curriculum vitae
3. Cover Letter
4. E-mail writing

UNIT – III

PRESENTATIONAL SKILLS

1. Oral presentation
2. Power point presentation
3. Poster presentation
4. Stage Dynamics

UNIT – IV
CORPORATE SKILLS

1. Dress code
2. Telephonic skills
3. Net-etiquettes

UNIT – V
GETTING READY FOR JOB

1. Group Discussion
2. Interview skills
3. Psychometric test.

Minimum Requirements for Advanced Professional Communication Skills Lab:

The English Language Lab shall have two parts:

1. Computer Assisted Language Learning (CALL) Lab: The Computer Aided Language Lab for 60 Students with 60 systems one Master Console, LAN facility and English Language Software for self-study by learners.
2. English for Corporate Communication Skills Lab with movable chairs and audio visual aids with a P. A. system, Projector, a Digital stereo audio & video system and Cam corderetc.

System Requirement (Hardware component):

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

Specifications

i) a) Intel(R) core (TM) i3
   b) Speed 3.10GHZ
   c) RAM – 4GB
   d) Hard Disk – 320 GB

ii) Headphones with High quality

Software

Walden Info Tech Software

REFERENCES

1. Effective Tech Communication, Rizvi, Tata McGraw – Hill Education, 2007.
2. Communication skills, Sanjay Kumar & Pushpalatha, Oxford University Press, 2012.
3. Writing Tutor. Advanced English Learners' Dictionary, 9th Edition, Oxford University Press, 2015.
4. Powerful Vocabulary Builder, Anjana Agarwal, New Age International Publishers, 2011.
5. Listening Extra, Miles Craven, Cambridge University Press, 2008.

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B.Tech – M.E

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(18ME0324) OPERATIONS RESEARCH

COURSE OBJECTIVES

The objective of this course to

1. *Learn about different Research models.*
2. *Know about Transportation and Assignment problems.*
3. *Develop the best strategy of Game and identifying the Queuing theory.*
4. *Learn about sequence and optimum Duration of the Project.*
5. *Understand the importance of Replacement models and Inventory control.*

COURSE OUTCOMES

On successful completion of this course are able to

1. *Create mathematical models of the real time situations by using different research models.*
2. *Implement Transportation and Assignment problems to solve the real time industry problems.*
3. *Choose the best strategy of Game and capable of identifying the suitable queuing theory.*
4. *Find the sequence and optimum Duration of the Project, by applying CPM and PERT Technique in real time industry.*
5. *Apply knowledge in Replacement models and Inventory control Models.*
6. *Summarize the different Techniques used in Replacement and Inventory*

UNIT-I

Introduction to OR and Linear Programming: OR definition–Types of Operations Research models; Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Big-M Method, Degeneracy - Problems

UNIT-II

Transportation Problem: Formulation; Initial Basic Feasible Solution-North-West Corner Rule, Least Cost Method, Vogel‘s Approximation Method, Modified Distribution (MODI) Method, Unbalanced Transportation - Problems

Assignment Problem: Formulation, Optimal Solution -Traveling Salesman problem

UNIT-III

Game Theory: Introduction – Minimax (Maximini) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy and Mixed Strategies – 2 X 2 Games – Dominance Principle

Queuing Theory: Introduction to queuing system–Service Channel, Arrival Pattern, Size of Population, Service Pattern, Queue Discipline, Customer Behavior, Probability Distribution-Birth & Death Process, Simple Problems on Single Service channel only

UNIT-IV

PERT & CPM: Introduction, Difference between PERT and CPM, Terminology- Activities, Events, Predecessor, Early Start, Early Finish, Late Start & Late Finish Times, Earliest Occurrence and Latest Occurrence of the Event, Total Float, Free Float, Independent Float; CPM- Deterministic Model; PERT-Probabilistic Model, Critical Path, Optimal Project Duration, Least Possible Project Duration- Problems

UNIT-V

Replacement: Failure Mechanism of Items**,** Types of Replacements-Individual Replacement policy, Group Replacement policy, Replacement of items fail suddenly –problems

Sequencing: Terminology -Johnson's Algorithm for n-jobs x 2 Machines and n-jobs x 3 machines models - Problems

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TEXT BOOKS

1. S. D. Sharma, *Operations Research*, KNRN Publications. 17th Edition 2015
2. Hamdy A Taha , *Operations Research,* Pearson Publications, 9th Edition 2015

REFERENCES

1. M. Mahajan, *Operations Research*, Dhanpat Rai & Co, 2016
2. Er. Premkumar Guptha & Dr.D.S. Hira, *Operations Research,* S. Chand Publications 2012.
3. R. Panneerselvam, *Operations Research*, PHI, 2nd Edition, 2012

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(18ME0325) AUTOMOBILE ENGINEERING

COURSE OBJECTIVES

The objectives of this course is to

1. *Study basic principles of actual Automobile systems*
2. *Understand the construction and principle of operation various parts of an automobile*
3. *Identify the importance and features of different systems like axle, differential, brakes, Steering, suspension, and balancing*
4. *Describe the working of various Fuel supply system and pollution in Automobile Systems*
5. *Gain knowledge in functioning of the engine and its accessories, gear box, clutch, braking system*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Identify the different parts of the automobile system for future developments in the automobile industry*
2. *Understanding the working of various parts like engine, transmission, clutch, brakes*
3. *Describe how the steering and the suspension systems operate*
4. *Apprehend the environmental implications of automobile emissions*
5. *Identify Construction, working, preventive maintenance, trouble shooting and diagnosis of various Automobile Systems*
6. *Understand importance and features of different systems like axle, differential, steering, suspension, and balancing*

UNIT I

Engine Components & Chassis: IC engine components-Functions- SI and CI Engine combustion and combustion chambers

Types of drives: Types of Automobiles - vehicle chassis, frame and body construction

UNIT II

Fuel Supply System: Fuel injection system for MPFI, CRDI and Turbocharger

Pollution standards: National & International pollution control techniques- Three way catalytic converter, Alternate fuels

UNIT III

Ignition System: Need- Battery coil and magnetic coil ignition system, Engine cooling system-Necessity-types

Engine lubrication: Properties of Lubricants- Grading- Types of lubrication Systems- Filters

Electrical system: Starting system- Bendix drive. Solenoid switch-lighting- horn- wiper-fuel gauge-speedometer-temperature indicator

UNIT IV

Transmission System: Clutches-Need-classification-fluid coupling-materials and required properties

Gear Box: Types- over drive- torque converter, propeller shaft- Hotch-kiss drive, torque tube drive, Universal Joint, Differential, Rear Axle, front axle

UNIT V

Steering system: Steering gears, steering Mechanism – Ackerman Steering Mechanism & Davis Steering Mechanism

Suspension System: Rigid Axle Suspension System and Independent Suspension System-Torque bar, shock absorber

Braking System: Air Brakes, Hydraulic Brake System, Pneumatic and Vacuum Brake Systems, ABS, EBD and Traction control

TEXT BOOKS

1. Kirpal Singh, *Automobile Engineering,* Vol.1 & Vol.2, Standard Publishers Distributors, 13th Edition, 2013
2. William Crouse, *Automobile Engineering*, TMH, 10th Edition, 2006

REFERENCES

1. Ramalingam K.K, *Internal combustion engines – theory and practice* SciTech Publication India Pvt. Ltd, Chennai, 3rd Edition 2000
2. Willam H.crouse, *Automotive Engines* Mc Graw Hill Publishers, 8th Edition1985
3. R.K. Rajput, *Automobile Engineering,* Laxmi Publications, 1st Edition, 2013

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(18ME0334) GAS DYNAMICS AND JET PROPULSION
[Professional Elective Course (PEC) – II]

COURSE OBJECTIVES

The objectives of this course is to

1. *Understand the basic difference between incompressible and compressible flow and effect of Mach number*
2. *Know the phenomenon of flow through the ducts and the frictional effect on flow*
3. *Comprehend the concept of normal and oblique shock waves*
4. *Recognize the importance of jet propulsion in space and system involved*
5. *Know the importance of propellants in space Technology*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Distinguish the Compressible and incompressible flow*
2. *Illustrate the Flow through ducts and variation of flow parameters*
3. *Analyze the Normal and Oblique shock waves, Prandtl-Meyer relations*
4. *Explain the Types of propulsion systems and its performance*
5. *Classify the propellants and combustion chambers used in the jet propulsion*
6. *Summarize the Applications of Gas dynamics in space and jet propulsion*

UNIT I

Basic Concepts: Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility

Isentropic Flows: Isentropic flow through variable ducts – Nozzle and Diffusers, Uses of gas tables, Problems

UNIT II

Flow Through Ducts: Flows through constant area ducts with heat transfer (Rayleigh flow), Momentum equation, impulse function and friction (Fanno flow) curve

Variation of Flow Properties: Variations of mach number with duct length, isothermal flow with friction, Problems

UNIT III

Normal and Oblique Shocks: Governing equations – Variation of flow parameters across the normal and oblique shocks

Rankine-Hugoniot Equations: Prandtl – Meyer relations – Shock Expansion Theory-Applications, Problems

UNIT IV

Jet Propulsion: Theory of jet propulsion – Operating principle, cycle analysis,Thrust equation – Thrust power and propulsive efficiency – Stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines

Combustors: Gas turbine, Ram jet, Supersonic and after burners, Components of jets and its efficiencies, Problems.

UNIT V

Propellants: Classification of propellants, Equilibrium composition- solid and liquid propellant, Ignition and combustion- Propellant feeding systems

Space Propulsion: Theory of rocket propulsion-Types of rocket engines –Losses in rocket engines, Rocket applications, Performance study- Staging – Terminal and characteristic velocity- Applications- Engine-Aircraft matching.

TEXT BOOKS

1. John J and Keith T, *Gas Dynamics*, Pearson Education, 4th Edition, 2006
2. S. Senthil, *Gas Dynamics and Jet Propulsion*, ARS Publications, 6th Edition, 2009
3. Ganesan. V, *Gas Turbines*, Tata McGraw Hill Publishing Co, 2010

REFERENCES

1. Hill P. and C Peterson, *Mechanics and Thermodynamics of Propulsion*, Addison Wesley Publishing Company, 2nd Edition, 1992
2. John D Anderson, *Modern Compressible Flow, McGraw-Hill Publishing Company*, 2nd Edition, 1996
3. R D Zucker, O Biblarz, *Fundamentals of Gas Dynamics*, John Wiley & Sons, 2nd Edition, 2002

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(18ME0335) TURBO MACHINES
[Professional Elective Course (PEC) – II]

COURSE OBJECTIVES

The objectives of this course is to

1. *Gain Knowledge in classification of turbo machines*
2. *Understand energy transfer and losses in centrifugal compressors, axial fans and steam turbines*
3. *Elucidate an overview of different types of turbo machinery used for energy transformation, such as pumps, fans, compressors, as well as hydraulic and steam turbines.*
4. *Comprehend the applications of turbo machinery in power generation, power absorption and transportation sectors.*
5. *Explain the working principles of turbo machines and apply it to various types of machines*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Understand the definition of turbo machinery.*
2. *Identify various types of turbo machinery.*
3. *Apply the Euler's equation for turbo machinery to analyze energy transfer in turbo machines.*
4. *Understand the principle of operation of pumps, fans, compressors and turbines.*
5. *Perform the preliminary design of turbo machines like pumps, rotary compressors and turbines.*
6. *Summarize the different types of techniques used in turbines.*

UNIT I

Introduction: Definition of turbo machine, parts of turbo machines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynolds number, Unit and specific quantities.

Thermodynamics of fluid flow: Application of first and second law of thermodynamics to turbo machines, Efficiencies of turbo machines, Static and Stagnation states, Incompressible fluids and perfect gases, overall isentropic efficiency, stage efficiency and polytropic efficiency for both compression and expansion processes. Reheat factor.

UNIT II

Energy exchange in Turbo machines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of reaction, Utilization factor, Relation between degree of reaction and utilization factor, Problems.

General Analysis of Turbo machines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head – capacity relationship, Problems.

UNIT III

Steam Turbines: Classification, Single stage impulse turbine, Condition for maximum blade efficiency, Stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, Maximum utilization factor.

Reaction turbine: Parsons's turbine, Condition for maximum utilization factor, Reaction staging, Problems.

UNIT IV

Hydraulic Turbines: Classification, Pelton turbine – Velocity triangles, Design parameters, Maximum efficiency.

Francis turbine: Velocity triangles, Design parameters, Runner shapes for different blade speeds.

Draft tubes: Types and functions. Kaplan and Propeller turbines - Velocity triangles, Design parameters. Problems.

UNIT V

Centrifugal Pumps: Classification and parts of centrifugal pump, Different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Priming, Pumps in series and parallel, Problems.

Centrifugal Compressors: Stage velocity triangles, Slip factor, Power input factor, Stage work, Pressure developed, Stage efficiency, surging and problems.

Axial flow Compressors: Expression for pressure ratio developed in a stage, Work done factor, Efficiencies and stalling, Problems.

TEXT BOOKS

1. V. Kadambi and Manohar Prasad, *An Introduction to Energy Conversion*, Volume III, Turbo machinery, New Age International Publishers, reprint 2008
2. S. M. Yahya, Turbines, *Compressors & Fans*, Tata McGraw Hill Co. Ltd., 2nd Edition, 2002

REFERENCES

1. M. S. Govinde gouda and A. M. Nagaraj, *Text Book of Turbo machines*, M. M. Publications, 4Th Ed, 2008
2. S. L. Dixon, *Fluid Mechanics & Thermodynamics of Turbo machines,* Elsevier 2005
3. D. G. Shepherd, *Principals of Turbo machines,* The Macmillan Company,1964

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(18ME0336) REFRIGERATION & AIR CONDITIONING

[Professional Elective Course (PEC) – II]

COURSE OBJECTIVES

The objectives of this course is to

1. *Understand in-depth study of theory of refrigeration and air conditioning*
2. *Explain the design aspects of Refrigeration & Air conditioning systems*
3. *Elucidate the underlying principles of operations in different Refrigeration & Air*
4. *conditioning systems and components*
5. *Identify the need of integration of Air distribution system*
6. *Analysis and design the techniques of refrigeration and air-conditioning systems*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Describe the ideal refrigeration cycles and applications of refrigeration systems*
2. *Compute the COP and power requirement of vapour compression refrigeration system, vapour absorption refrigeration system*
3. *Explain the working principles of various components of vapour compression*
4. *refrigeration system*
5. *Analyze air-conditioning processes using the principles of psychrometry*
6. *Evaluate cooling and heating loads in an air-conditioning system*
7. *Summarize the different types of techniques used in Steam jet Refrigeration*

UNIT-I

Introduction: Introduction to Refrigeration - Unit of Refrigeration and C.O.P. – Ideal cycles, Necessity & Applications of Refrigeration, Types of Air Refrigeration Systems

UNIT-II

Vapour Compression Refrigeration System: Working principle and Essential components of VCR system. Vapor compression cycle: P-h and T-S diagrams - deviations from theoretical cycle – sub cooling and super heating, problems

Refrigerants: Desired properties- Environmental issues- Refrigerant Mixtures - Cascade systems & Applications

UNIT-III

Other Refrigeration Systems: Vapour absorption system –Electrolux, Two fluid and three fluid System, Steam jet refrigeration- Thermoelectric refrigeration- Vortex tube refrigeration systems

UNIT-IV

Introduction to Air Conditioning: Psychrometric Properties and Processes-Psychrometric chart & Construction, Need for ventilation and Infiltration – concepts of RSHF, GSHF, ERSHF and ADP, Air conditioning loads, Problems

UNIT-V

Air Conditioning Systems and Distribution of Air: Human comfort, effective temperature & Comfort chart, classifications of Air Conditioning Systems- summer, winter & all year round air conditioning, problems

Ducts: Classification of Ducts, Methods of Duct Design – Grills and Registers

TEXT BOOKS

1. C.P.Arora & Domkundwar, *Refrigeration and Air conditioning*, 3rd Edition, McGraw Hill, New Delhi, 2010
2. R.S.Khurmi. *Refrigeration and Air conditioning*, 5th Edition, S.Chand Publishers, 2006

REFERENCES

1. Roy J. Dossat, *Principles of Refrigeration*, 4th edition, Pearson Education Asia, 2009
2. Stoecker, W.F. and Jones J. W., *Refrigeration and Air Conditioning*, McGraw Hill, New Delhi, 1986
3. R.K Rajput, *A text book of Refrigeration and Air conditioning*, 6th Edition, Katson Books, 2013

Data Book: Refrigerant and Psychrometric Properties (Tables & Charts) SI Units, Mathur M.L. & Mehta F.S, Jain Brothers

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(18ME0337) MECHATRONICS & ROBOTICS
[Professional Elective Course (PEC) – III]

COURSE OBJECTIVES

The objectives of the course is to

1. *Provide knowledge on Mechatronics system and applications*
2. *Make the students acquaintance with various sensors and transducers used in systems*
3. *Understand the numerous actuators and signal conditioning methods.*
4. *Create awareness about microprocessor and microcontrollers needed for the mechatronic systems*
5. *Learn the concepts of Robotics, kinematics, principles of robot drives and controls.*
6. *Acquire the knowledge on robotic programming and software used in it*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Identify the importance of mechatronics system, components and its applications.*
2. *Explain the types of actuators and signal conditioning.*
3. *Recognize the PLC in Automation.*
4. *Explain the anatomy of robot and may apply knowledge of it in the design of new robotic structure.*
5. *Illustrate the applications of various types of end effectors and sensor devices.*
6. *Elucidate the robot programming languages used in different types of robot.*

UNIT I

Introduction: Mechatronics- Need, Components, design process, benefits and applications- Control Systems- GUI- Real Time operating systems.

Sensor and transducers: Static characteristics of sensors, Displacement: strain gauge element- pneumatic sensor- force: strain gauge load cell –Temperature: bimetallic strips**,** resistance temperature detectors, thermocouple- Pyrometer, force: strain gauge element- Selection criteria for sensors.

UNIT II

Actuators: Introduction, Characteristics and limitations, Actuators Types, Mechanical, Electrical, Hydraulic and Pneumatic Actuation Systems, -Timing Belts.

Signal Conditioning & Electronic Interface Subsystems: Signal conditioning- process, functions, resistors, capacitors, Filters, ADC and DAC- Electronic Interface Subsystems- coupling, protection schemes, circuit breakers.

UNIT III

Microcontrollers and Programmable Logic Controllers: Microcontroller- elements, memory, 8051 Microcontroller- Programmable Logic Controller- PLC Programming using ladder diagrams, PLC selection criteria- Shift registers.

Introduction to Industrial Robotics: Classification of Robot Configurations, functional line diagram, degrees of freedom, Joints, factors to be considered in the design of grippers- Robot Applications in Material Transfer- Material handling, loading and unloading - Process - Assembly and Inspection.

UNIT IV

Kinematics: Homogeneous transformations as applicable to rotation and translation-Simple problems Specifications of matrices, D-H notation Joint coordinates and world coordinates- Forward and inverse kinematics.

Dynamics: Differential transformation and manipulators, Jacobians. Lagrange- Euler and Newton-Euler formuations.

UNIT V

Trajectory Planning: Path planning and avoidance of obstacles, Slew motion, joint interpolated motion-straight line motion.

Programming Languages: Robot programming, languages and software packages- practices.

TEXT BOOKS

1. W. Bolton, *Mechatronics*, Pearson education, 4th Edition, 2012
2. M.P. Groover, Mitchell Weiss, Roger N, Nagel and Nicholas G. Odrey, *Industrial Robotics*, Tata McGraw-Hill Edition, 3rd Print, 2008

REFERENCES

1. HMT, *Mechatronics*, Tata McGraw Hill Publishers, New Delhi
2. Fu K S, *Robotics* , Mc Graw Hill, 4th Edition, 2010
3. K.P. Ramachandran *Mechatronics Integrated mechanical Electronic System* Wiley India Pvt. Ltd, New Delhi, 2008

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(18ME0338) FINITE ELEMENT ANALYSIS
[Professional Elective Course (PEC) – III]

COURSE OBJECTIVES

The objectives of this course is to

1. *Learn basic principles of finite element analysis procedure*.
2. *Gain knowledge in the concepts of Nodes and elements*
3. Know *the theory and characteristics of finite elements that represent engineering structures.*
4. *Apply finite element solutions to structural, thermal, dynamic problems.*
5. *Develop the knowledge and skills needed to effectively evaluate finite element analyses*.

COURSE OUTCOMES

On successful completion of this course the students will able to

1. *Understand the concepts behind formulation methods in FEA*
2. *Explain the concepts of Nodes and elements used in the analysis*
3. *Identify the application and characteristics of FEA elements such as bars, beams, trusses and frames.*
4. *Develop element characteristic equation and generation of global equation.*
5. *Apply suitable boundary conditions to iso-parametric and dynamic problems.*
6. *Summarize the different types of techniques used in FEA.*

UNIT – I

Introduction to Finite Element Analysis: Introduction, procedure, steps, applications, Steps involved in Two dimensional, Three dimensional equilibrium equations

Formulation Techniques: Methodology- Engineering problems and governing differential equations-finite elements- Variational methods-potential energy method

UNIT – II

One Dimensional Finite Element Methods: Bar elements- temperature effects- Element matrices- assembling of global stiffness matrix- Application of boundary conditions-Elimination and penalty approaches- solution for displacements, reaction, stresses

Heat transfer problems: One - dimensional - conduction and convection problems on fins

UNIT – III

Trusses: Element matrices- assembling of global stiffness matrix- solution for displacements, reaction, stresses, temperature effects.

Beams and Frames: Element matrices- assembling of global stiffness matrix- solution for displacements, reaction, stresses

UNIT – IV

Two Dimensional Problems: CST- LST, four nodded and eight nodded rectangular elements, Lagrange basis for triangles and rectangles -serendipity interpolation functions.

Heat Transfer Problems: Conduction and convection- two-dimensional fin

UNIT – V

Iso-parametric Formulation: Concepts - sub parametric- super parametric elements- numerical integration

Finite Elements in Structural Dynamics: Dynamic equations- Eigen value problems, and their solution methods, simple problems

TEXTBOOKS

1. Daryl L. Logan, *A First Course in the Finite Element Method*, 4th Edition, Chris Carson publishers, 2012
2. Tiruapathi R Chandruputla and Ashok D. Belegundu, *Introduction to Finite element in Engineers*, 4th Edition, Pearson Publishers, 2012
3. J N Reddy, *Finite element method in Heat transfer and fluid dynamics*, CRC press, 2nd Edtion, 1994

REFERENCES

1. Zienckiwicz O.C. & R. L. Taylor, *Finite Element Method*,McGraw-Hill,1983
2. J. N. Oden, *Finite Element of Nonlinear continuation*, McGraw-Hill, New York, 1971
3. K. J. Bathe, *Finite element procedures*, Prentice-Hall, 1996

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(18ME0339) QUALITY CONTROL & RELIABILITY ENGINEERING
[Professional Elective Course (PEC) – III]

COURSE OBJECTIVES

The objectives of this course is to

1. *Introduce the concept of SQC*
2. *Understand the process control and acceptance sampling procedure and their application.*
3. *Provide knowledge on the importance of reliability in the manufacturing sector.*
4. *Develop the knowledge and skills needed in quality control.*
5. *Illustrate the basic concepts and techniques of modern reliability engineering tools.*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Summarize the concept of Quality and Process control for variables*
2. *Apply the process control for attributes*
3. *Explain the concept of sampling and to solve problems*
4. *Describe the concept of Life testing, Reliability and techniques involved*
5. *Attain the basic techniques of quality improvement, fundamental knowledge of statistics and probability*
6. *Use control charts to analyze for improving the process quality*

UNIT I

Introduction: Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality Cost-Variation in process causes of variation
Process Control for Variables: Theory of control chart- uses of control chart –X chart, R chart and chart - process capability –process capability studies and simple problems. Six sigma concepts

UNIT II

Process Control for Attributes: Control chart for attributes –control chart for non-conforming – p chart and np chart, control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

UNIT III

Acceptance Sampling: Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques
O.C. Curves: Introduction – producer's Risk and consumer's Risk - AQL, LTPD, AOQL concepts - standard sampling plans for AQL and LTPD- uses of standard sampling plans

UNIT IV

Life testing: Objective – failure data analysis, mean failure rate, mean time to failure, mean time between failure, hazard rate

Reliability: Weibull model, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems, Acceptance sampling based on reliability test – O.C Curves

UNIT V

Quality and Reliability: Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis –Product development–Product life cycles

TEXT BOOKS

1. Douglas.C. Montgomery, *Introduction to Statistical quality control*, 7th Edition, John Wiley 2012
2. Srinath. L.S., *Reliability Engineering*, Affiliated East west press, 2008

REFERENCES

1. Besterfield D.H., *Quality Control*, Prentice Hall, 2013
2. Connor, P.D.T.O., *Practical Reliability Engineering*, John Wiley, 2012
3. Danny Samson, *Manufacturing & Operations Strategy*, Prentice Hall, 1991

Note: Use of approved statistical table permitted in the examination

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(18ME0340) ADVANCED WELDINGPROCESSES

[Professional Elective Course (PEC) – IV]

COURSE OBJECTIVES

The objectives of this course is to

1. *Know the different welding processes and the basics of gas, metal arc welding*
2. *Understand the application of fusion welding processes and its variables*
3. *Provide the knowledge of various power source characteristics to give sound welding*
4. *Knowledge about different methods of solid state welding processes*
5. *Explain various advanced welding processes and its applications*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Explain Different types of welding processes, classification and use of gas, manual metal arc welding*
2. *Identify various applications of fusion welding and its parameters*
3. *Acquire the knowledge of different power sources used and its control for good weld ability*
4. *Identify various Applications of solid state welding processes and its uses*
5. *Elucidate numerous bonding techniques used for joining of metals*
6. *Describe various advanced welding processes used and its applications*

UNIT-I

Introduction to Welding: Classification and survey of welding and allied processes.

Gas welding: Introduction and gases, types of flames, weld quality, applications and variants of oxy-fuel gas welding.

Arc welding: Shielded metal arc welding operation, metal fusion and weld penetration, variants of SMAW process and applications of SMAW. Arc welding consumables, Electrode coverings and their functions.

UNIT-II

Arc welding: Types of fluxes and their compounding Wire and strip electrodes. Gas shielded welding TIG and MIG and MAG/ CO_2processes. Shielding gases, electrode polarity, current setting, metal transfer and arc length control.

Plasma welding: Cutting processes. Equipment maintenance, applications.

UNIT-III

Electrical power sources for welding: Characteristics of transformer- rectifier and motor generator sets, Pulsed currents.

Advanced welding and Joining Processes: Pressure welding processes, Solid phase bonding, Friction welding, Ultrasonic welding.

UNIT-IV

Explosive welding: Diffusion bonding and adhesive bonding. Resistance welding Spot, Seam and projection welding, Flash and upset butt welding.

UNIT-V

Brazing and soldering: Electron Beam, Laser and Infrared Welding. Principles, Operational details, Process controls and application of above processes.

TEXT BOOKS

1. Dr. R.S. Parmar, *Welding Processes and Technology*, Khanna Publishers, 3rd Edition, 1996
2. Houldcroft, P. T, *Welding Processes* by PHI Publications, 1967

REFERENCES

1. Konigsberger. F, *Welding Technology*, Mc Graw Hill Publications
2. Little, Richard L, *Welding and Welding Technology*, TATA McGraw Hill Publications
3. Rossi, Boniface E, *Welding Engineering* by PHI, Publications

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(18ME0341) MODERN MACHINING METHODS
[Professional Elective Course (PEC) – IV]

COURSE OBJECTIVES

The objectives of this course is to

1. *Give a good perspective with adequate depth to understand the modern machining methods*
2. *Impart the knowledge of relative advantages of modern manufacturing methods over conventional techniques*
3. *Analyze the process parameters of different modern manufacturing methods*
4. *Make acquainted the various unconventional manufacturing processes*
5. *Know about the applications of advanced manufacturing processes*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Select the appropriate process based on the purpose of requirement*
2. *Infer the fundamentals of modern manufacturing methods.*
3. *Estimate the material removal rate and cutting force, in an industrially useful manner, for modern machining processes.*
4. *Analyze the various processes operating under uncertain conditions.*
5. *Choose the various finishing operations used in machining of metals.*
6. *Develop novel hybrid techniques from the state of art techniques available.*

UNIT I

Introduction: Introduction to Modern machining methods– Need – Classification-Ultrasonic Machining, Abrasive Jet Machining, Water Jet Machining-Working Principles – equipment used – Process parameters – MRR- Applications

UNIT II

Electric Discharge Machining (EDM): Working Principles – Equipment's – Process Parameters – MRR – Tool – Power Circuits – Tool Wear – Dielectric – Flushing

CNC EDM and Wire cut EDM: Working Principle – Advantages and Disadvantages – Applications

Electrical Discharge Grinding: Working Principle – Equipment – Process Parameters – Applications

UNIT III

Chemical Machining: Etchants – Maskant - Techniques of applying maskants – Process Parameters – Surface finish and MRR – Applications

Electro-Chemical Machining(ECM): Principles of ECM – equipment's – Surface Roughness and MRR Electrical circuit– Process parameters– Applications

Electro Chemical Grinding (ECG) and Electro Chemical Honing (ECH): Principle– equipments – Process Parameters – Advantages and disadvantages – Applications

UNIT IV

Thermal Energy Based Processes – Classification- Electron Beam Machining, Laser Beam Machining, Plasma Arc Machining-Principles – Equipment – Types – Beam control techniques – Applications

UNIT V

Micro & Nano Machining: - Conventional Micro Machining - Non conventional micro, nano manufacturing and finishing approaches - Micro and Nano Finishing Processes - Micro and Nanofabrication Techniques.

TEXT BOOKS

1. V.K. Jain, *Advanced Machining Processes,* Allied Publishers Pvt. Ltd, 2016
2. Benedict. G.F, *Non-traditional Manufacturing Processes,* Taylor & Francis, New York, 2010

REFERENCES

1. Pandey. P.C. and Shan H.S, *Modern Machining Processes,* Tata McGraw-Hill, New Delhi, 2017
2. Hassan El-Hofy, *Advanced Machining Processes,* McGraw-Hill, New york, 2005

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(18ME0342) POWER PLANT ENGINEERING

[Professional Elective Course (PEC) – IV]

COURSE OBJECTIVES

The objectives of this course is to

1. *Illustrate power development in India from various resources, create awareness on economics of power plants and pollution control*
2. *Demonstrate working of steam power plant, cycles & their improvement. Fuel handling equipment and its fuel combustion*
3. *Tell about the working of diesel and gas turbine power plants with accessories*
4. *Explain hydrological cycle, classify hydroelectric power plants and their working*
5. *Classify nuclear reactors, describe their power generation process and radioactive waste disposal methods*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Identify energy sources in India, explain layouts of power plants, power plant economics and environmental considerations of various power plants*
2. *Utilize fuel handling equipment and explain the need for proper combustion equipment in a steam power plant*
3. *Describe types of diesel engines and gas turbine power plants, their construction, working principle and its auxiliaries*
4. *Define water power, conversion process of water energy into electric power through various types of hydroelectric power plants*
5. *Illustrate various forms of nuclear fuel, its usage in nuclear reactors for power generation and the necessity of careful disposal of nuclear waste*
6. *Summarize resources for energy, methods of power generation and protection of our environment*

UNIT I

Introduction to the Sources of Energy: Resources and Development of Power in India, Layouts of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants, General Arrangement of Power Distribution System

Power Plant Environmental Considerations: Effluents from Power Plants and their impact on environment –Pollutants and Pollution Standards – Methods of Pollution Control. Inspection and Safety Regulations

UNIT II

Fuel Handling Equipment: Types of Coals, Coal Handling Equipment, Coal Storage, Ash Handling Systems

Combustion and Combustors: Properties of Coal – Overfeed and Under Feed Fuel Beds, Travelling Grate Stokers, Spreader Stokers, Retort Stokers, Pulverized Fuel Burning System and its Components, Combustion Needs and Draught System, Cyclone Furnace, Dust Collectors, Cooling Towers And Heat Rejection

UNIT III

Diesel Power Plant: Introduction, Engine- Types- Construction, Diesel power plant layout with auxiliaries- Fuel supply, Lubrication, cooling, Supercharging

Gas Turbine Plant: Introduction – Classification - Construction – Layout with auxiliaries – Principles of working closed and open cycle gas turbines, Inter cooling, Reheating & Regenerating, Advantages and disadvantages of combined cycle power plants

UNIT IV

Hydro Electric Power Plant: Water Power – Hydrological Cycle / Flow measurement – Drainage area characteristics – Hydrographs – Storage and pondage – Classification of dams and spill ways

Hydro Projects and Plant: Classification – Typical layouts – Plant auxiliaries – Plant operation pumped storage plant, Selection of prime movers, Governing of turbines

UNIT V

Nuclear Power Station: Nuclear fuel – Nuclear fission, Chain reaction, Breeding and Fertile materials – Nuclear reactor –Reactor operation

Nuclear Reactors: Pressurized water reactor, Boiling water reactor, Sodium-graphite reactor, Fast breeder reactor, Homogeneous reactor, Gas cooled reactor, Radiation hazards and shielding – Radioactive waste disposal

TEXT BOOKS

1. P.K. Nag, *Power Plant Engineering*, Tata McGraw Hill Publications, 4th Edition, 2014
2. Arora and S. Domkundwar, *A Course in Power Plant Engineering*, DhanpatRai & Co Publishers, 5th Revised Edition, 2010

REFERENCES

1. R K Rajput, *A Text Book of Power Plant Engineering*, Laxmi Publications, 4th Edition, 2012
2. Ramalingam, *Power plant Engineering*, SciTech Publishers, 1st Edition, 2010
3. P.C. Sharma, *Power plant engineering*, S.K. Kataria Publications, 9th Revised Edition, 2019

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(18CE0146) PROJECT PLANNING AND CONTROL
[Open Elective – II]

COURSE OBJECTIVES

The objectives of this course is to

1. *Describe various elements of an engineering project and to draw the network*
2. *Perform PERT & CPM calculations and to identify the critical path*
3. *Perform various operations on the network*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Differentiate various tools for planning and controlling the project*
2. *Construct the network for a project*
3. *Perform PERT computations and evaluate the critical path*
4. *Perform CPM computations and identify the critical path*
5. *Optimize time and cost for a project*
6. *Work with network during the progress of a project by updating the network and allocating the resource*

UNIT – I

Project Management: Project planning – Project scheduling – Project controlling – Project monitoring and control – Project monitoring and information cell – Decision making in project management – Project life cycle

Basic Techniques of Project Management: Bar charts – Steps for the construction of a bar chart – Limitations of bar charts – Milestone charts – Velocity diagrams – Development of Network – CPM/PERT Networks – Advantages of network over milestone chart

UNIT – II

Elements of Network: Event – Activity – Dummy – Network rules – Graphical guidelines for network – Common partial situations in network – Numbering the events – Cycles

Development of Network: Planning for network construction – Modes of network construction – Steps in development of network – Work breakdown structure – Hierarchies

UNIT – III

PERT: Time Estimates: Uncertainties: Use of PERT – Time estimates – Frequency distribution – Mean, variance and standard deviation – Probability distribution – Beta distribution – Expected time

PERT: Time Computations & Network Analysis: Earliest expected time – Formulation for T_E – Latest allowable occurrence time – Formulation for T_L – Combined tabular computations for T_E and T_L – Slack – Critical path – Probability of meeting scheduled date

UNIT – IV

CPM: Network Analysis: CPM Process – CPM Network – Activity time estimate – Earliest event time – Latest allowable occurrence time – Combined tabular computations for T_E and T_L – Start and finish times of activity – Float – Critical activities and critical path

UNIT – V

CPM: Cost Model: Project cost – Indirect project cost – Direct project cost – Slope of direct cost curve – Total project cost and optimum duration – Contracting the network for cost optimization – Steps in time cost optimization

CPM: Updating: Updating process – Data required for updating – Steps in the process updating – When to update

Resources Allocation: Resources usage profiles: histograms – Resources smoothing – Resources levelling

TEXT BOOKS

1. Dr.B.C. Punmia, K.K. Khandelwal, *Project Planning and Control with PERT AND CPM*, Laxmi Publications (P) Ltd., 4th Edition, Reprint 2006
2. Dr.P.N. Modi, Sanjeev Modi and Rajeev Modi, *Program Evolution and Review Technique and Critical Path Method*, Standard Book House, 5th Edition, 2012

REFERENCES

1. L.S. Srinath, *PERT and CPM Principles and Applications,* Affiliated East-West Press (Pvt.) Ltd.
2. S.K. Bhattacharjee, *Fundamentals of PERT/CPM and Project Management*, Khanna Publishers
3. Kumar Neeraj Jha, *Construction Project Management: Theory and Practice,* Pearson, 2rd edition, 2015

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(18EE0236) SOLAR PHOTOVOLTAIC SYSTEMS
[Open Elective– II]

COURSE OBJECTIVES
The objectives of this course is to

1. *Develop a comprehensive technological understanding in solar PV system components*
2. *Provide in-depth understanding of design parameters to help design and simulate the performance of a solar PV power plant*
3. *Pertain knowledge about planning, project implementation and operation of solar PV power generation*

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

1. *Understand of renewable and non-renewable sources of energy*
2. *Gain knowledge about working principle of various solar energy systems*
3. *Analyze the solar power PV power generation*
4. *Applying the knowledge on to installation and integration of PV modules for different applications*
5. *Know the operation of different solar collectors in the market*
6. *Understand the solar thermal energy storage systems*

UNIT-1
Introduction

Sources of renewable energy; global potential for solar electrical energy systems. Solar radiation. Extra terrestrial and terrestrial solar spectrum; clear sky direct-beam radiation; total clear sky insulation on a collecting surface; radiation on the collector in tracking systems; calculation of average monthly insolation from measured data

UNIT-2
PV cells and modules

Solar Cell and its function, Solar Technologies, Solar Cell Parameters, Efficiency of Solar Cell, Solar PV Module, Rating of Solar PV Module, PV Module Parameters, Efficiency of PV Module, Measuring Module Parameters

UNIT-3
Solar Photovoltaic Module Array

Connection of PV Module in Series and Parallel, Estimation and Measurement of PV Module Power, Selection of PV Module.

UNIT-4
Solar PV System Design and Integration

Solar Radiation Energy Measurements, Estimating Energy requirement, Types of Solar PV System, Design methodology for SPV system, Design of Off Grid Solar Power Plant, Case studies of 3KWp Off grid Solar PV Power Plant, Design and Development of Solar Street Light and Solar Lantern, Off Grid Solar power Plant.

UNIT-5

Solar collectors and Solar energy storage

Different types of solar collectors, Flat plate and concentrated type collectors, Fundamental Terminologies of thermal storage, Sensible heat storage materials, Latent heat storage materials, Solar thermo-chemical energy storage systems, Advantages and disadvantages of solar thermal storage, application of thermal storage

TEXT BOOKS

1. Chetansingh solanki *Solar Photovoltaic* PHI, Learning private ltd., New dehli- 2018
2. G.D Rai *Non-conventional Sources of Energy* Khanna Publishers, Delhi, 2012

REFERENCE BOOKS

1. Chetansingh Solanki *Renewable Energy Technologies; A Practical Guide for Beginners* PHI School Books (2008)
2. Kothari D.P. and Signal K.C *Renewable Energy Sources and Emerging Technologies*, New Arrivals –PHI; 2 Edition (2011)

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(18EC0450) MATLAB PROGRAMMING
[Open Elective- II]

COURSE OBJECTIVES

The objectives of this course is to

1. *Understand the MATLAB Desktop, Command window and the Graph Window.*
2. *Be able to do simple and complex calculation using MATLAB.*
3. *Understand the mathematical concepts upon which numerical methods.*
4. *Understand the tools that are essential in solving engineering problems.*

COURSE OUTCOMES

On successful completion of this course, student will be able to

1. *Analyze and visualize data effectively by using MATLAB.*
2. *Apply numeric techniques and computer simulations to solve engineering-related problems.*
3. *Apply a top-down, modular, and systematic approach to design, write, test, and debug sequential MATLAB programs to achieve computational objectives.*
4. *Design and document computer programs and analyses in a careful and complete manner so as to effectively communicate results, to facilitate evaluation and debugging by another programmer, and to anticipate and resolve user errors.*
5. *Demonstrate understanding and use of fundamental data structures (classes).*
6. *Create and control simple plot and user-interface graphics objects in MATLAB.*

UNIT-I

Introduction to MATLAB: MATLAB Interactive Sessions, Menus and the toolbar, computing with MATLAB, Script files and the Editor Debugger, MATLAB Help System, Programming in MATLAB.

UNIT-II

Arrays: Arrays, Multidimensional Arrays, Element by Element Operations, Polynomial Operations Using Arrays, Cell Arrays, Structure Arrays.

UNIT-III

Functions & Files: Elementary Mathematical Functions, User Defined Functions, Advanced Function Programming, Working with Data Files.

UNIT-IV

Programming Techniques: Program Design and Development, Relational Operators and Logical Variables, Logical Operators and Functions, Conditional Statements, Loops, the Switch Structure, Debugging MATLAB Programs.

Plotting: XY- plotting functions, Subplots and Overlay plots, Special Plot types, Interactive plotting, Function Discovery, Regression, 3-D plots.

UNIT-V

Linear Algebraic Equations: Elementary Solution Methods, Matrix Methods for Linear Equations, Cramer Method, Undetermined Systems, Order Systems.

TEXT BOOKS

1. G. H. Golub and C. F. Van Loan, *Matrix Computations*, 3rd Edn, Johns Hopkins University Press, 1996.
2. B. N. Datta, *Numerical Linear Algebra and Applications*, Brooks/Cole, 1994

REFERENCES

1. William J Palm, *Introduction to MATLAB for Engineers*, 3rd edition, Mc Graw Hill
2. L. Elden, *Matrix Methods in Data Mining and Pattern Recognition*, SIAM Press, 2007
3. Amos Gilat, *MATLAB: An Introduction with Applications*,4th edition, WILEY

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(18CS0544) SOFTWARE DEVELOPMENT & TESTING
[Open Elective – II]

COURSE OBJECTIVES

The objectives of this course is to

1. *Illustrate the Software Development Models*
2. *Explain Software Requirements Engineering Process and SRS document*
3. *Illustrate the importance of modeling and modeling languages*
4. *Explain various testing methodologies*
5. *Explain Quality assurance and test cases*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *Define and develop as software project from requirement gathering to implementation*
2. *Ability to code and test the software*
3. *Ability to plan, estimate and maintain software systems*
4. *Understand the basic testing procedures*
5. *Able to generate test cases and test suites.*
6. *Test the applications manually by applying different testing methods and automation tools.*

UNIT-I

Introduction: Introduction to Software Engineering , Software Process, Software Myths, A generic view of process, A layered Technology, A Process Framework, Software Process Models, Unified process

Introduction to Agility: Agility, Agile Process, Agile Process Models

UNIT-II

Requirements Analysis and Specification: Requirements Engineering, Eliciting Requirements, Requirements Analysis, Types of Requirements, Requirement Modeling and Data Modeling, Concepts.

Architectural Design Concepts: The Design Process, Design Concepts, Design Model, Software Architecture, Architecture Styles.

UNIT-III

User Interface Design: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps.

Web App Design: Introduction, Web App Interface Design, Aesthetic Design, Content Design, Architecture Design, Navigation Design, Component-Level Design.

UNIT-IV

Software Testing: Introduction, Levels of Software Testing – Unit Testing, Module Testing, Integration Testing, System Testing, Acceptance Testing, Alpha Testing, Beta Testing,

Approach to Software Testing: Types of Software Testing - Black Box Testing, White Box Testing, Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Art of Debugging.

UNIT-V

Software Quality: Software Testing Life Cycle, Software Quality, Testing Principles, Test Process – Testing Activities, Quality Assurance.

Software Test Cases: Introduction to Test cases, Test Case Selection – Test Planning and Design – Test Execution – Case Study on Test tools and automation.

TEXT BOOKS

1. Roger S.Pressman, *Software Engineering*- A practitioner‘s Approach, McGraw-Hill International Edition, 7th edition, 2001
2. Software Testing techniques, Boris Beizer, Dreamtech, 2nd Edition

REFERENCES

1. Ian Sommerville, *Software Engineering*, 8th Edition, Pearson Education, 2008
2. Richard Fairley, *Software Engineering Concepts*, McGraw Hill, 2004
3. Dr.K.V.K.K. Prasad, *Software Testing Tools*, Dreamtech

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(20HS0815) ENTREPRENEURSHIP DEVELOPMENT
[Open Elective – II]

COURSE OBJECTIVES

The objectives of this course is to

1. *Acquire necessary skills and knowledge required for organizing and carrying out entrepreneurial activities,*
2. *Develop the ability of analyzing and understanding business situations in which entrepreneurs act*
3. *Develop the ability of analyzing various aspects of entrepreneurship – especially of taking over the risk, and the specificities as well as the pattern of entrepreneurship development*

COURSE OUTCOMES

On successful completion of the course, the students will be able to

1. *The ability to discern distinct entrepreneurial traits and identify the successful elements of successful entrepreneurial ventures*
2. *Consider the legal and financial conditions for starting a venture and to assess the opportunities and constraints for new ventures*
3. *Design strategies for the successful implementation of ideas*
4. *Comprehend the evaluation of business opportunity from the prospective of an investor*
5. *Identify the most suitable sources of finance for start-ups*
6. *Write and execute their own business plan*

UNIT-I

Introduction to Entrepreneurship - Concept of entrepreneurship, Enterprise and entrepreneurship; Characteristics, Qualities, Functions of entrepreneur and advantages of entrepreneurship; Role of entrepreneurship in economic development, Challenges faced by entrepreneurs, Entrepreneurial scenario in india and abroad; Elements of social entrepreneurship, Types of entrepreneurs, Entrepreneurship vs. Intrapreneurship.

UNIT-II

Small Business and its Importance - Introduction, Need, Classification of micro, small and medium enterprises (MSMEs), Role of MSMEs, Problems of MSMEs, Steps for starting MSMEs, The role of government in supporting MSMEs in India.

Forms of Business Organization: Evaluation of Form of Business organization: Sole Proprietorship, Partnership, Joint hindu family, Joint stock company and Co-operative society. Special forms of business ownership: Licensing, Franchising and Leasing.

UNIT-III

Innovation and Idea Generation in Entrepreneurship - Concept of invention and innovation, Types of innovation, Sources of innovation, Importance of innovation in entrepreneurship. Sources of new ideas, Methods of generating ideas and opportunity recognition and idea generation in entrepreneurship. Intellectual property rights (IPRs): Patents, Trademarks, Copyrights, and Trade secrets. E-commerce and business start-ups, Sources of information for Start-up entrepreneurs in india. Problems of start-ups without IPRs.

UNIT-IV

Entrepreneurial Motivation - Concept of motivation and factors influencing the entrepreneurs; Motivational theories- Maslow's need hierarchy theory, Mcclelland's acquired need theory. Entrepreneurship development programs (EDPs) - Need and role of EDPs. Opportunities for entrepreneurship in present scenario. Successful entrepreneurs.

Financing of Enterprises - Source of financing - Debt capital, seed capital, venture capital, Loans available for starting ventures in India, Role of government agencies in small business financing, Role of consultancy organizations.

UNIT-V

Project Planning and Feasibility Study - Meaning of project, Project life cycle, and Stages of planning process. Project planning and feasibility, Project proposal and report preparation.

TEXT BOOKS:

1. Robert D Hisrich, Mathew J.Manimala, Michael Peters, Dean A.Shepherd, *Entrepreneurship*, Mc Graw Hill Education, 8th Edn
2. Vasanth Desai, *The Dynamics of Entrepreneurial Development and Management*, Himalaya Publishing House, Mumbai

REFERENCES:

1. S.S. Khanka, ,*Entrepreneurial Development*, S. Chand and Company Ltd
2. H. Nandan, *Fundamentals of Entrepreneurship*, PHI
3. Bholanath Dutta , *Entrepreneurship Management* – Text and cases, Excel Books
4. Ramachandran, *Entrepreneurial Development*, Tata McGraw Hill, New Delhi

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(18ME0326) COMPUTER AIDED ANALYSIS LAB

COURSE OBJECTIVES

The *objectives of this course is to*

1. *Make students understand and learn about the analysis and simulation of simple mechanical parts*
2. *Explain the different kinds of analysis and apply the basic principles to find out the stress and other related parameters of bars, beams loaded with loading conditions*
3. *Lean the basic principles to carry out dynamic analysis to know the natural frequency of different kind of beams*
4. *Develop the student's skills in proper modeling, meshing, and setting up material properties, loads, and constraints for computer simulation and analysis*
5. *Have the proper knowledge on analysis and plotting results*

COURSE OUT COMES

On successful completion of this course the student will be able to

1. *Use the modern tools to formulate the problem, and able to create geometry, discretize, apply boundary condition*
2. *Solve problems of bars, truss, beams, plate and to find stress with different loading condition*
3. *Demonstrate the deflection of beams subjected to point, uniformly distributed and varying loads, further to use the available results*
4. *Draw shear force and bending moment diagrams*
5. *Analyze the given problem by applying basic principle to solve and demonstrate 1D and 2D heat transfer with conduction and convection boundary conditions*
6. *Carry out dynamic analysis and finding natural frequencies for various boundary conditions and also analyze with forcing function*

LIST OF EXPERIMENTS:

1. Introduction to ANSYS
2. Structural Analysis of a Truss Member
3. Analysis of Simply Supported Beam
4. Stress Analysis of Cantilever Beam
5. Stress Analysis of A Plate With Circular Hole
6. Stress Analysis of Rectangular L Bracket
7. Bars of Tapered Cross Section Area
8. Conductive Heat Transfer Analysis in Rectangular 2DComponent.
9. Conductive Heat Transfer Analysis in Different Geometry 2DComponents.
10. Conductive Heat Transfer Analysis in2DComponents of composite materials.

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(18ME0328) ROBOT PROGRAMMING LAB

COURSE OBJECTIVES

The *objectives of this course is to*

1. *Provide knowledge on the various robotic systems with the help of mathematical models.*
2. *Distinguish the different types of coordinate systems in the robot.*
3. *Know the different types of drawings on the paper through robot.*
4. *Creating programming structures of Igus programming.*
5. *Using and applying knowledge on various operations by using robot.*

COURSE OUTCOMES

On successful completion of this course the student will be able to

1. *Describe the characteristics of a robotic system from its dynamic model.*
2. *Identify the different types of coordinate systems in the robot.*
3. *Draw the different types of drawings on the paper through robot.*
4. *Generate programming structures for Igus programming.*
5. *Producing various operations like drilling, welding, pick and place etc.,by using robot.*
6. *Making pick and place operations by using robot.*

LIST OF EXPERIMENTS

Part-A: Basic Movements

1. Moving the robot in different coordinate systems
2. Pick and Place movement
3. Drawing a Square on a Paper
4. Drawing Inner frames on a Paper
5. Writing your name on a Paper
6. Draw a Circle on a Paper
7. Working with programming structures of Igus programming

Part-B: Industrial Applications

1. Drilling
2. Fixing a bulb
3. Deburring
4. Cube welding
5. Custom object shape welding
6. Palletizing
7. Pick and Place Matrix operation
8. Robot collaboration