



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
Course Structure for Mechanical Engineering
B. Tech Course
(2015-16)

II B. Tech – II Sem

S.No.	Course Code	Subject	L	Tu	Lab	C
1	15A54401	Mathematics - IV	3	1	-	3
2	15A99301	Basic Electrical and Electronics Engineering	3	1	-	3
3	15A03401	Machine Drawing	3	1	-	3
4	15A03402	Kinematics of Machines	3	1	-	3
5	15A03403	Thermal Engineering – 1	3	1	-	3
6	15A03404	Manufacturing Technology	3	1	-	3
7	15A03405	Thermal Engineering Laboratory	-	-	4	2
8	15A03406	Manufacturing Technology Laboratory	-	-	4	2
9	15A03407	Comprehensive Online Examination-I	-	-	-	1
		Total	18	06	08	23

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B. Tech II - II sem (M.E)

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(15A54401) MATHEMATICS -IV

(Common to ECE, EEE)

OBJECTIVES:

To enable the students to understand the mathematical concepts of special functions & complex variables and their applications in science and engineering.

OUTCOMES:

The student achieves the knowledge to analyse the problems using the methods of special functions and complex variables

UNIT – I:

Special Functions: Gamma and Beta Functions – their properties – Evaluation of improper integrals. Series Solutions of ordinary differential equations (Power series and Frobenius Method).

UNIT – II:

Bessel functions – Properties – Recurrence relations – Orthogonality. Legendre polynomials – Properties – Rodrigue's formula – Recurrence relations – Orthogonality.

UNIT – III

Functions of a complex variable – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thomson method. Conformal mapping: Transformation of z , $\ln z$, z^2 , $\sin z$, $\cos z$, Bilinear transformation - Translation, rotation, magnification and inversion – Fixed point – Cross ratio – Determination of bilinear transformation.

UNIT – IV

Complex integration: Line integral – Evaluation along a path and by indefinite integration – Cauchy's integral theorem – Cauchy's integral formula – Generalized integral formula. Complex power series: Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series. Singular point – Isolated singular point – Pole of order m – Essential singularity.

UNIT – V

Residue – Evaluation of residue by formula and by Laurent's series – Residue theorem. Evaluation of integrals of the type

(a) Improper real integrals $\int_{-\infty}^{\infty} f(x) dx$ (b) $\int_0^{2\pi} R(\cos \theta, \sin \theta) d\theta$ (c) $\int_{-\infty}^{\infty} e^{imx} f(x) dx$

TEXT BOOKS:

- 1.Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
- 2.Engineering Mathematics, Volume - III, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher

REFERENCES:

1. Mathematics III by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publications.
2. Advanced Engineering Mathematics, Peter V.O'Neil, CENGAGE publisher.
3. Advanced Engineering Mathematics by M.C. Potter, J.L. Goldberg, Edward F.Aboufadel, Oxford.

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(15A99301) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**PART – A**
BASIC ELECTRICAL ENGINEERING**Objectives:**

Basic Electrical Engineering contains basic Electrical Laws, Network theorems, AC & DC generators and motors which are widely used in industry are covered and their performance aspects will be studied.

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 & TWO PORT NETWORKS

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 and TRANSFORMERS

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.

Outcomes:

After going through this course the student gets a thorough knowledge on basics of Network theorems, Two port networks, DC Motors and Transformers with which he/she can able to apply the above conceptual things to real-world problems and applications.

TEXT BOOKS:

1. Basic Electrical Engineering - By M.S.Naidu and S. Kamakshiah – TMH.
2. Basic Electrical Engineering –By T.K.Nagasarkar and M.S. Sukhija Oxford University Press.

REFERENCES:

1. Theory and Problems of Basic Electrical Engineering by D.P.Kothari & I.J. Nagrath PHI.
2. Principles of Electrical Engineering by V.K Mehta, S.Chand Publications.
3. Fundamentals of Electrical Electronics Engineering by T.Thyagarajan, SCITECH Publications 5th Edition-2007
4. Electrical and Electronic Technology-By Hughes – Pearson Education.

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 and FETs: 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 I_C , I_B and I_E . Transistor Biasing- Fixed Bias, Voltage Divider Bias, Transistor Applications- Transistor as an Amplifier, Transistor as a Switch,. 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.

UNIT III

Oscillators and Op-Amps: Sinusoidal Oscillators, Barkhausen Criteria for Oscillator Operation, Components of an Oscillator-Transistor Amplifier Circuits, Feedback Circuits and Oscillator Circuits, Classification of Oscillators, LC Tuned, RC Phase Shift Oscillator circuits.

Operational Amplifiers(Op-Amps)-Symbol of an Op-Amp, single Input and Dual Input Op-Amps(Differential Amplifier), Characteristics of an Ideal Op-Amp, Basic Forms of Op-Amps-Inverting & Non-Inverting Amplifiers, Applications of Op-Amps, summing, Differential, Integrator, differentiator Amplifier.

TEXT BOOKS:

1. Basic Electrical and Electronics Engineering, M.S.Sukhija, T.K.Nagsarkar, Oxford University Press, 1st Edition, 2012.
2. Basic Electrical and Electronics Engineering, S.K Bhattacharya, Pearson Education, 2012.

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(15A03401) MACHINE DRAWING**Course Objective:**

To make the students to understand the concepts of I.S. conventions, methods of dimensioning, the title boxes, to draw the machine elements and simple parts.

To make the students to understand and draw assemblies of machine parts and to draw their sectional views

UNIT I

Machine Drawing Conventions: Need for drawing conventions- introduction to IS conventions

Conventional representation of material, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs. Parts not usually sectioned.

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

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

Learning Outcome & Suggested Student Activities:

This unit is useful to prepare the students for representing their ideas at International standards and will be able to convey in without much effort globally with ease. Students will acquire skills to draft on a drawing sheet without much effect. Students are advised to visit machine shop.

UNIT II

Drawing of Machine Elements and simple parts: Selection of Views, additional views for the following machine elements and parts with drawing proportions:

Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, set screws, Keys, cottered joints and knuckle joint, Rivetted joints for plates, flanged & protected flanged joint. Shaft coupling, spigot and socket pipe joint. Journal, and foot step bearings.

Learning Outcome & Suggested Student Activities:

Students can represent various details of an object quickly without much time and ambiguity. These drawings can be easily prepared and understood by both the people in a manufacturing industry and the consumers too. Students are advised to visit machine shop.

UNIT III

Assembly Drawings: Drawings of assembled views for the part drawings of the following.

Engine parts- stuffing boxes, cross heads, Eccentrics, Petrol Engine-connecting rod, piston assembly.

Other machine parts- Screw jack, Machine Vice, single tool post.

Valves: Steam stop valve, feed check valve. Non return valve.

Learning Outcome & Suggested Student Activities:

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. It is not necessary that all the components to be made locally only. Students are advised to visit body building and assembly unit.

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

Text Books:

1. *Machine Drawing* – N Siddeswar, P. Kannaiah, VVS Sastry, Mc Graw Hill, 2015
2. *Machine Drawing*– K.L. Narayana, P.Kannaiah & K.Venkata Reddy, New Age Publishers, 4th Edition, 2012.

Reference Books:

1. *Machine Drawing*– P.S. Gill, S.K. Kataria & Sons, 17th Edition, 2012.
2. *Machine Drawing*– Dhawan, S.Chand Publications, 1st Revised Edition, 1998.
3. *Machine Drawing* – Ajeet Singh, McGraw Hill, 2012
4. *Machine Drawing*– Luzzader, PHI Publishers, 11th Edition.
5. *Textbook of Machine Drawing*–K.C.John, 2009, PHI learning, 1st Edition.

NOTE:

- The End exam will be for 4 hrs in the following format
- All answers should be on the drawing sheet only. Answers on the drawing sheet only will be valued.
- First Angle Projections
 - Q1 Questions set on section I of the syllabus 2 out of 3 or 2 out of 4 to be answered with a weightage of 4 marks each-08 marks.
 - Q2 Questions set on section II of the syllabus 2 out of 3 to be answered with a weightage of 10 marks each-20 marks.
 - Q3 Drawing of assembled views of section III items of syllabus with a weightage of 42 marks

Suggestions:

Student should buy a book mentioned under Text books and study all the exercises given at the end of each chapter to equip him/her with the required ammunition.

Student should visit an automobile shop while the unit is being disassembled / assembled.

Student should go through the exercises given under assembly drawings referring to various books in the library to improve his assimilation capacity.

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(15A03402) KINEMATICS OF MACHINES
Course Objective:

The objective of this course is to cover the kinematics and dynamics of planar single degree of freedom mechanisms. After this course the student should have general mathematical and computational skills to enable the kinematics and dynamics analysis of machine elements including linkages, cams and gears and also becomes familiar with gear terminology and drawing of the cam profiles.

UNIT I

MECHANISMS AND MACHINES: Elements or Links – Classification – Rigid Link, flexible and fluid link. Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs – constrained motion – completely, partially or successfully constrained and incompletely constrained. Mechanisms and machines – classification of mechanisms and machines – kinematic chain – inversion of mechanisms – inversions of quadric cycle chain – single and double slider crank chain. Mobility of mechanisms. Straight Line Motion Mechanisms- Exact and approximate, copiers and generated types –Peaucellier, Hart and Scott Russel – Grasshopper, Watt, Tchebicheff and Robert Mechanisms. Pantograph.

Learning outcome & Suggested Student Activities:

After completion of this unit students are in a position to identify different mechanisms, inversions of different kinematic chains and also to find mobility of mechanisms. To get more clarity on mechanisms and machines, the following URLs will be highly useful to the students to understand various concepts of mechanisms and machines.

<http://www.cs.cmu.edu/~rapidproto/mechanisms/chpt2.html>,

<http://www.mhprofessional.com/downloads/products/0071704426/0071704426-ch01.pdf>

UNIT II

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.

Belt, Rope and Chain Drives : Introduction, Belt and rope drives, selection of belt drive- types of belt drives, materials used for belts and ropes, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, Chains-length, angular speed ratio, classification of chains.

Learning outcome & Suggested Student Activities:

After completion of this chapter students are able to understand the mechanism of Hooke's joint, steering mechanisms and belt friction. And are also able to solve numerical problems on Hooke's joint, belt and rope drives. Students can go through the textbooks for the problems on Hooke's joint, belt and rope drives. The following URLs will be highly useful to the students to understand various concepts of steering mechanisms and belt friction.

[http://nptel.iitm.ac.in/courses/Webcourse-](http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Machine%20design1/pdf/mod13les1.pdf)

[contents/IIT%20Kharagpur/Machine%20design1/pdf/mod13les1.pdf](http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Machine%20design1/pdf/mod13les1.pdf)

<http://www.youtube.com/watch?v=YzGM8Uc2HB0>

UNIT III
KINEMATICS

Velocity and Acceleration Diagrams- Velocity and acceleration – Motion of link in machine – Determination of Velocity and acceleration – Graphical method – Application of relative velocity method – Slider crank mechanism, four bar mechanism. Acceleration diagrams for simple mechanisms, Coriolis acceleration, determination of Coriolis component of acceleration. Kleins

construction. Analysis of slider crank mechanism for displacement, velocity and acceleration of slider using analytical method

Instantaneous Centre Method: Instantaneous centre of rotation, centrode and axode – relative motion between two bodies – Three centres in-line theorem – Locating instantaneous centres for simple mechanisms and determination of angular velocity of points and links.

Learning outcome & Suggested Student Activities:

After completion of this unit student are able to draw velocity and acceleration diagrams of simple plane mechanisms by using relative velocity method and instantaneous center method. Students can go through the textbooks given for the problems on analysis of mechanisms. The following URLs will be highly useful to the students to understand various concepts of velocity and acceleration diagrams.

<http://www.freestudy.co.uk/dynamics/velaccdiag.pdf>,

http://ebooks.library.cornell.edu/k/kmoddl/pdf/013_005.pdf

UNIT IV

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

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

Learning outcome & Suggested Student Activities:

After completion of this unit student are able to know gears terminology, types of gears, length of path of contact, contact ratio and interference in gears. Further students are also able to design the gears to avoid interference and to calculate train value for different gear trains. Students may go through text books given for more number of problems on gears and gear trains. Students may also refer the books authored by R.L. Norton and also by J.E. Shigley in addition to the textbooks for this unit to get more clarity on this unit. The following URLs will be highly useful to the students to understand various concepts of gears and gear trains http://www.nptel.iitm.ac.in/courses/IIT-MADRAS/Machine_Design_II/pdf/2_1.pdf, [http://vedyadhara.ignou.ac.in/wiki/images/e/e8/BME-020_B-3\(Unit_10\).pdf](http://vedyadhara.ignou.ac.in/wiki/images/e/e8/BME-020_B-3(Unit_10).pdf)

<http://www.youtube.com/watch?v=qLVwXZ2sS48>

UNIT V

CAMS: Definitions of cam and follower – uses – Types of followers and cams – Terminology. Types of follower motion - Uniform velocity – Simple harmonic motion and uniform acceleration. Maximum velocity and maximum acceleration during outward and return strokes. Drawing of cam profiles.

ANALYSIS OF MOTION OF FOLLOWERS: Tangent cam with roller follower – circular arc (Convex) cam with flat faced and roller follower.

Learning outcome & Suggested Student Activities:

After completion of this unit the students are able to draw displacement diagram and cam profile for different types of motions of the follower. And also to find the displacement, velocity and acceleration of the follower at different positions of cam with specified contours. The following URLs will be highly useful to the students to understand various concepts of drawing the cam profile for different followers. <http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-Delhi/Kinematics%20of%20Machine/site/coursecontent/cntmod10.htm>, <http://www.youtube.com/watch?v=UpS8OjdXSow>

<http://www.youtube.com/watch?v=UpS8OjdXSow>

Text Books:

1. *Theory of Machines*, S.S. Rattan, Tata McGraw Hill Publishers, 3rd Edition, 2013.
2. *Kinematics and dynamics of machinery*, R.L Norton ,Tata McGraw Hill Publishers, 1st Edition, 2009.

Reference Books:

1. *Theory of Machines and Mechanisms*, 3rd Edition, J.E. Shiegley et. al, Oxford International Student Edition.
2. *The theory of Machines*, Ballaney, Kanna Publishers
3. *Theory of Machines*, Thomas Bevan, Pearson (P) 3rd Edition, 2012.

NOTE : Exam should be conducted in Drawing Hall

Suggestions:

Students may visit nearby machine tool shops and automobile workshops to know about different mechanisms, gears, gear trains, flexible drives and cams. Students are suggested to search the web and identify different URLs which provide animations of mechanisms for better visualization and understanding purpose.

WEB References:

<http://nptel.iitk.ac.in>

<http://ptumech.loremate.com/tom1/node/1>

<http://www.youtube.com/watch?v=6coD3oOuhr8>

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(15A03403) THERMAL ENGINEERING – I
Course Objective:

The objective of this subject is to impart the knowledge of engine components, working principles of IC engines, auxiliary systems, the combustion aspects of SI and CI engines in addition to the methods of improving performance. The students shall become aware on the latest developments in the field of IC engines like MPFI, CRDI etc. and also shall become familiar about the working of Reciprocating and Rotary Compressors. The student also shall apply the thermodynamic concepts in IC engines and compressors.

UNIT I

I.C. ENGINES: Definition of Engine And Heat Engine, I.C Engine Classification – Parts of I.C.Engines, Working of I.C. Engines, Two Stroke & Four Stroke I.C.Engines SI & CI Engines, Valve and Port Timing Diagrams.

Learning Outcome & Suggested Student Activities:

After completion of the unit, student can know working of both S.I and C.I engines with the help of indicator diagrams. Student can differentiate the working of 2-S and 4-S engines and also can draw valve and port timing diagrams. Student can know applications of IC engine in the automobile industry. Students are advised to visit nearby automobile service center/station and engines laboratory for Knowing the various engines and engine components. Student can also see various types of engines fitted to two wheelers, four wheelers, and diesel power plants. The following URLs will be highly useful to the students to understand various aspects of I.C.Engines <http://www.youtube.com/watch?v=XfJvRTQP3M>, http://www.youtube.com/watch?v=MNrVYG_NdD4, http://www.youtube.com/watch?v=W8oWq2Iv_W4, www.youtube.com/user/Techtrixinfo.

UNIT II

Fuel System: S.I. Engine: Fuel Supply Systems, carburetor types Air Filters, Mechanical and Electrical Fuel Pump – Filters– Gasoline Injection Systems..

Cooling & Lubrication Systems: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo Siphon, Water And Forced Circulation System; Lubrication Systems-Flash, Pressurized and Mist Lubrication.

Ignition System: Function Of An Ignition System, Battery coil Ignition System, Magneto Coil Ignition System, Electronic Ignition System using Contact Breaker, Electronic Ignition using Contact Triggers – Spark Advance And Retard Mechanism.

Learning Outcome & Suggested Student Activities:

Student can understand the fuel supply systems, cooling, lubrication and ignition systems. Student can understand how auxiliary systems play key role in increasing the performance of an I.C engine.

Student is advised to visit nearby automobile service center/station for getting practical knowledge about various auxiliary systems. Student can find the radiator (air cooling and water cooling) in front of heavy vehicles and stationary engines and air cooling for two wheelers and three wheelers.

The following URLs will be highly useful to the students to understand various aspects of fuel supply systems, filters, cooling, lubrication systems and Ignition systems.

<http://www.youtube.com/watch?v=ksG4ypoMEaM>; <http://www.youtube.com/watch?v=LwrL-Cn9HT8>; http://www.youtube.com/watch?v=O_Y3dM8ZApo; <http://www.youtube.com/watch?v=mmmcj53TNic>

UNIT III

Fuels and Combustion:

S I engine :Normal Combustion and Abnormal Combustion – Importance of Flame Speed and Effect of Engine Variables – Type of Abnormal Combustion, Pre-Ignition and Knocking (Explanation) – Fuel Requirements and Fuel Rating, Anti Knock Additives, Combustion Chambers.

C.I. Engines: Stages Of Combustion – Delay Period And Its Importance – Effect Of Engine Variables – Diesel Knock– Combustion Chambers (DI And IDI), Fuel Requirements And Fuel Rating.

Learning Outcome & Suggested Student Activities:

Student can understand the flame propagation inside the cylinder, stages of combustion in S.I and C.I engines. Student can understand the knocking phenomenon. Student can know about Octane number and Cetane number of fuels and properties of fuel. Combustion Process is very typical process practically students can't see but student can understand the combustion process by visiting following URLs. Students are suggested to know various losses occurred through combustion chamber, at least theoretically.

<http://www.youtube.com/watch?v=ep1NhANcCL4>; <http://www.youtube.com/watch?v=pqa4zCo4erY>

UNIT IV

Testing and Performance : Parameters of Performance - Measurement of Cylinder Pressure, Fuel Consumption, Air Intake, Exhaust Gas Composition, Brake Power – Determination of Frictional Losses And Indicated Power – Performance Test – Heat Balance Sheet and Chart.

Learning Outcome & Suggested Student Activities:

Student can be familiar with indicated power, brake power and friction power and their methods of measurement. Student can understand the methods to increase the engine performance. Also, student can know calculating specific fuel consumption, A/F ratio and mean effective pressure and estimating heat losses etc. Students are advised to visit heat engines laboratory for analyzing the effect of various parameters on engine performance.

To better understand the above following URLs are useful.

<http://web.iitd.ac.in/~ravimr/courses/mel345/ignou-notes.pdf>;

UNIT V

Air Compressors: Reciprocating Compressors, Effect of Clearance volume in Compressors, Volumetric Efficiency, Single Stage and Multi Stage Compressors, Effect of Inter cooling and Pressure Drop in Multi - Stage Compressors, Problems Related to Reciprocating Compressors, Working principles of Roots blower, Vane type Blower, Centrifugal Compressor - Axial Flow Compressors, Working Principle of Rotary Compressors.

Learning Outcome & Suggested Student Activities:

Student can differentiate the working of reciprocating and rotary air compressors. Student can calculate work done by single and multistage reciprocating air compressors. Student can understand how intercooling reduces the work done / kg of air.

To gain further practical knowledge students are advised to visit laboratory/automobile workshop to see different types of compressors. The following URLs will be highly useful to the students to understand the air compressors.

<http://www.ustudy.in/node/5106> ; <http://www.youtube.com/watch?v=Ue7BkzBARXw>

<http://www.youtube.com/watch?v=6zYHUXSG3HE>;

<http://www.youtube.com/watch?v=OuK6nGibFqY>

Students are advised to refer the text book of “Internal Combustion Engine Fundamentals” by John B. Heywood.

Text Books:

1. Internal Combustion Engines / V. Ganesan- TMH, 4th Edition, 2012
2. Thermal Engineering / Rajput / Lakshmi Publications, 9th Edition, 2013

Reference Books:

1. I.C. Engines fundamentals, Heywood, McGrawHill, 1st Edition, 2011
2. IC Engines – Mathur & Sharma – Dhanpath Rai & Sons, 2010

3. *Engineering fundamentals of IC Engines* – Pulkrabek, Pearson, PHI, 2nd Edition, 2009
4. *Thermal Engineering*, Rudramoorthy – TMH, 10th Edition, 2010
5. *Thermodynamics & Heat Engines*, B. Yadav, Central publishing house., Allahabad, 2002
6. *Thermal Engineering* – R.S. Khurmi & J.K. Gupta – S.Chand, 15th Edition, 2012

WEB Resources:

<http://autoclub.rso.siuc.edu/frange.html>

<http://www.howstuffworks.com/engine1.htm>

<http://inventors.about.com/library/inventors/blinternalcombustion.htm>

<http://www.animatedengines.com/>

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(15A03404) MANUFACTURING TECHNOLOGY
Course Objective:

By this subject the students will understand how manufacturers use technology to change raw materials into finished products. The students shall also introduce the basic concepts of casting, pattern preparation, gating system and knowledge on basic features of various welding and cutting processes. And also to study the concepts of surface treatment process, their characteristics and applications

UNIT I

CASTING: Definition, elements, Steps involved in making a casting– Types of patterns - Patterns and Pattern making — Materials used for patterns, pattern allowances and their Construction. Principles of Gating, Gating ratio and design of Gating systems, time of filling the cavity. Design of core prints, buoyancy principle. Moulds: definition, mould materials, types of moulds, moulding methods, moulding machines, tests. Solidification of casting – Concept – Solidification of pure metal and alloys, short & long freezing range alloys.

Learning Outcome & Suggested Student Activities:

Students can understand the elements of casting, construction of patterns and gating systems, moulds, methods of moulding, moulding machines and solidification of castings of various metals. Students are advised to visit URLs <http://www.nptel.iitm.ac.in/> and iitr.ac.in, www.learnerstv.com/Free-Engineering-Video-lectures-ltv234-Page1.htm.

UNIT II

SPECIAL CASTING PROCESSES: Process Mechanics, characteristics, parameters and applications of Centrifugal, Die, and Investment casting.

RISERS – Types, function and design, casting design considerations, Design of feeding systems i.e., sprue, runner, gate and riser, moulding flasks

METHODS OF MELTING: Crucible melting and cupola operation, steel making processes. Casting inspection and defects

Learning Outcome & Suggested Student Activities:

Students can understand the different types of special casting methods and their applications, design of risers and feeding systems, crucible melting, cupola operation and steel making process. The students may also be able to design a casting process on his own. The students are also advised to visit a Casting Industry nearby to get practical exposure.

UNIT III

A) **WELDING** : Classification of welding processes types of welds and welded joints and their characteristics, design of welded joints, Gas welding, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding.

B) **CUTTING OF METALS:** Oxy – Acetylene Gas cutting, water plasma. Cutting of ferrous, non-ferrous metals

Learning Outcome & Suggested Student Activities:

Students can understand the different types of welding processes, welds and weld joints, their characteristics, cutting of ferrous and non-ferrous metals by various methods. The students are advised to visit nearby welding shop for better understanding of welding process.

UNIT IV

Mechanics, characteristics, process parameters, applications of Inert Gas welding, TIG & MIG welding, Friction welding, Induction welding, Explosive welding, Laser welding, Soldering &

Brazing and adhesive bonding. Heat affected zones in welding; welding defects – causes and remedies – destructive and nondestructive testing of welds

Learning Outcome & Suggested Student Activities:

Students can understand about advanced welding process, heataffected zone(HAZ), Defects and Identification Methods. The students are advised to visit nearby welding shop and MFT Lab in the college.

UNIT V

SURFACE ENGINEERING: Surface treatment processes and their characteristics and applications.

(a) Overlay coatings (b) Diffusion coatings (c) Thermal or mechanical modification of surfaces

Learning Outcome & Suggested Student Activities:

Students can understand the various surface treatment processes. Student is advised to visit the nearby surface coating industry.

Text Books:

1. Manufacturing Technology, Vol I P.N. Rao, Tata Mc Graw Hill, 4th Edition, 2013
2. Manufacturing Technology, Kalpakjain, Pearson education, 4th Edition, 2002

Reference Books:

1. Production Technology, K.L Narayana, I.K. International Pub, 3rd Edition, 2013
2. Manufacturing Process Vol. I, H.S.Shah Pearson, 2013,
3. Principles of Metal Castings, Rosenthal, Tata Mc Graw Hill, 2nd Edition, 2001
4. Welding Process, Parmar.
5. Manufacturing Technology, R.K. Rajput, Laxmi Pub, 1st Edition, 2007
6. Workshop Technology – B.S.RaghuVamshi – Vol I.

WEB References:

NPTEL Lectures

http://teacher.buet.ac.bd/shabnam/14250_ch3.pdf http://me.emu.edu.tr/majid/MENG364/2_casting.pdf

<http://en.wikipedia.org/wiki/Metalworking>

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(15A03405) THERMAL ENGINEERING LABORATORY

1. Valve / Port Timing Diagrams of an I.C. Engines
2. Performance Test on a 4 -Stroke Diesel Engines
3. Performance Test on 2-Stroke Petrol engine
4. Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Engine
5. Retardation and motoring test on 4- stroke engine
6. Heat Balance of an I.C. Engine.
7. Air/Fuel Ratio and Volumetric Efficiency of an I.C. Engines.
8. Performance Test on Variable Compression Ratio Engines for CI Engines
9. Performance Test on Reciprocating Air – Compressor Unit
10. Study of Boilers
11. Dismantling / Assembly of Engines to identify the parts and their position in an engine.
12. Engine Emission Measurement for SI & CI Engines.

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(15A03406) MANUFACTURING TECHNOLOGY LABORATORY**Minimum of 12 Exercises need to be performed****I. METAL CASTING LAB:**

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

II. WELDING LAB:

- Arc Welding: Lap & Butt Joint - 2 Exercises
- Spot Welding - 1 Exercise
- TIG Welding - 1 Exercise
- Plasma welding and Brazing - 2 Exercises (Water Plasma Device)

III. MECHANICAL PRESS WORKING:

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

IV. PROCESSING OF PLASTICS:

- Injection Moulding
- Blow Moulding

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