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

II B. Tech – I Sem

S.No.	Course Code	Subject	L	Tu	Lab	C
1	15A54301	Mathematics - III	3	1	-	3
2	15A52301	Managerial Economics & Financial Analysis	3	1	-	3
3	15A01308	Mechanics of Solids	3	1	-	3
4	15A03301	Engineering Drawing for Mechanical Engineers	3	1	-	3
5	15A03302	Engineering Mechanics	3	1	-	3
6	15A03303	Thermodynamics	3	1	-	3
7	15A01309	Mechanics of Solids Lab	-	-	4	2
8	15A03304	Computer Aided Drafting Lab	-	-	4	2
		Total	**18**	**06**	**08**	**22**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech II - I sem (M.E)	**T**	**Tu**	**C**
	3	**1**	**3**

(15A54301) MATHEMATICS-III

(Common to All Branches)

Objectives:

- This course aims at providing the student with the concepts of Matrices, Numerical Techniques and Curve fitting.

UNIT – I

Elementary row transformations-Rank – Echelon form, normal form – Consistency of System of Linear equations. Linear transformations. Hermitian, Skew-Hermitian and Unitary matrices and their properties. Eigen Values, Eigen vectors for both real and complex matrices. Cayley – Hamilton Theorem and its applications – Diagonolization of matrix. Calculation of powers of matrix and inverse of a matrix. Quadratic forms – Reduction of quadratic form to canonical form and their nature.

UNIT – II

Solution of Algebraic and Transcendental Equations: The Bisection Method – The Method of False Position– Newton-Raphson Method, Solution of linear simultaneous equation: Crout's triangularisation method, Gauss - Seidal iteration method.

UNIT – III

Interpolation: Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

UNIT – IV

Curve fitting: Fitting of a straight line – Second degree curve – Exponentional curve-Power curve by method of least squares. Numerical Differentiation for Newton's interpolation formula. Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule.

UNIT – V

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method-Runge-Kutta Methods. Numerical solutions of Laplace equation using finite difference approximation.

TEXT BOOKS:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Introductory Methods of Numerical Analysis, S.S. Sastry, PHI publisher.

REFERENCES:

1. Engineering Mathematics, Volume - II, E. Rukmangadachari Pearson Publisher.
2. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S. Chand publication.
3. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
4. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.

Outcomes: The student will be able to analyze engineering problems using the concepts of Matrices and Numerical methods.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech II - I sem (M.E)	**T**	**Tu**	**C**
	3	**1**	**3**

(15A52301) MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Course Objectives: The objective of this course is to equip the student with the basic inputs of Managerial Economics and Economic Environment of business and to impart analytical skills in helping them take sound financial decisions for achieving higher organizational productivity.

Unit I: INTRODUCTION TO MANAGERIAL ECONOMICS

Managerial Economics – Definition- Nature- Scope - Contemporary importance of Managerial Economics - Relationship of Managerial Economics with Financial Accounting and Management. **Demand Analysis**: Concept of Demand-Demand Function - Law of Demand - Elasticity of Demand- Significance - Types of Elasticity - Measurement of elasticity of demand - Demand Forecasting- factors governing demand forecasting- methods of demand forecasting.

UNIT II: THEORY OF PRODUCTION AND COST ANALYSIS

Production Function- Least cost combination- Short-run and Long- run production function- Isoquants and Isocosts, MRTS - Cobb-Douglas production function - Laws of returns - Internal and External economies of scale - **Cost Analysis**: Cost concepts and cost behavior- Break-Even Analysis (BEA) -Determination of Break Even Point (Simple Problems)- Managerial significance and limitations of Break- Even Point.

UNIT III: INTRODUCTION TO MARKETS AND NEW ECONOMIC ENVIRONMENT

Market structures: Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition- Monopoly-Monopolistic Competition-Oligopoly-Price-Output Determination - Pricing Methods and Strategies-Forms of Business Organizations- Sole Proprietorship- Partnership – Joint Stock Companies - Public Sector Enterprises – New Economic Environment- Economic Liberalization – Privatization - Globalization.

UNIT IV: INTRODUCTION TO FINANCIAL ACCOUNTING AND ANALYSIS

Financial Accounting – Concept - Emerging need and Importance - Double-Entry Book Keeping- Journal - Ledger – Trial Balance - Financial Statements - Trading Account – Profit & Loss Account – Balance Sheet (with simple adjustments). Financial Analysis – Ratios – Liquidity, Leverage, Profitability, and Activity Ratios (simple problems).

UNIT V: CAPITAL AND CAPITAL BUDGETING

Concept of Capital - Over and Undercapitalization – Remedial Measures - Sources of Shot term and Long term Capital - Estimating Working Capital Requirements – Capital Budgeting – Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Learning Outcome: After completion of this course, the student will able to understand various aspects of Managerial Economics and analysis of financial statements and inputs therein will help them to make sound and effective decisions under different economic environment and market situations.

TEXT BOOKS:

1. Managerial Economics 3/e, Ahuja H.L, S.Chand, 2013.
2. Financial Management, I.M.Pandey, Vikas Publications, 2013.

REFERENCES

1. Managerial Economics and Financial Analysis, 1/e, Aryasri, TMH, 2013.
2. Managerial Economics and Financial Analysis, S.A. Siddiqui and A.S. Siddiqui, New Age International, 2013.

Accounting and Financial Mangement, T.S.Reddy & Y. Hariprasad Reddy, Margham Publishers.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

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

T	Tu	C
3	1	3

(15A01308) MECHANICS OF SOLIDS

Course Objective:

The objective of the subject is to learn the fundamental concepts of stress, strain and deformation of solids with applications to bars and beams. The students shall understand the theory of elasticity including strain/displacement and hooks law relationships. To accesses stresses and deformations through the mathematical models of beams for bending and bars for twisting or combination of both. The knowledge of this subject will help in the design & Theory of machines courses.

UNIT I

SIMPLE STRESSES & STRAINS: Elasticity and plasticity – Types of stresses & strains – Hooke's law – stress & strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Elastic moduli & the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain energy – Resilience – Gradual, sudden, impact and shock loadings. Principle stresses and strains-computation of principle stresses and strains on inclined planes-theory of failures- minimum principle stress, strain, shear stress and strain energy theories.

Learning Outcome & Suggested Student Activities:

This unit gives the student how to measure the strength of materials based on calculating stresses, strains and deformations for basic geometries subjected to axial loading and thermal effects. Students are advised to visit the URL http://nptel.iitm.ac.in/courses/IIT-MADRAS/Strength_of_Materials/Pdfs/1_1.pdf.

UNIT II

SHEAR FORCE AND BENDING MOMENT : Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

Learning outcome & Suggested Student Activities:

This unit gives awareness for the students how to draw shear force and bending moment diagrams for calculating maximum shear force and maximum bending moment for different types of beams with different lateral loadings conditions. This topic can be downloaded from the URL http://vedyadhara.ignou.ac.in/wiki/images/a/ad/BME-017_B-1(Unit_4).pdf

UNIT III

FLEXURAL STRESSES: Theory of simple bending – Assumptions – 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,T, Angle and Channel sections – Design of simple beam sections, crane hooks.

SHEAR STRESSES: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I , T angle sections, shear centre.

Learning outcome & Suggested Student Activities:

This unit gives knowledge to the students about the strength of the beams with different sections by bringing the relationship between the bending stress and maximum bending moment, bringing the relationship between the shear stress and maximum shear force which are calculated from previous unit. This topic can be downloaded from the following URL http://web.mit.edu/emech/dontindex-build/full-text/emechbk_7.pdf.

UNIT IV

TORSION OF CIRCULAR SHAFTS- Theory of pure torsion- Derivation of torsion equations; T/J=q/r=Nθ/L – Assumptions made in the theory of pure torsion- torsional moment of resistance-polar section modulus.

DEFLECTION 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, - U.D.L uniformly varying load. Mohr's theorems – Moment area method – application to simple cases including overhanging beams.

Learning outcome & Suggested Student Activities:

This unit gives awareness to the students how to calculate the shear strength of the solid and hallow shafts which are subjected to torsional loading in power transmitting. This topic related to torsion can be download from the following URLs

http://www.mae.ncsu.edu/zhu/courses/mae314/lecture/Lecture4_Torsion.pdf, and also gives better knowledge for students how to calculate deflections of beam using different methods under different boundary and loading conditions. Notes for this topic can be download from the web site http://nptel.iitm.ac.in/courses/IIT-MADRAS/Strength_of_Materials/Pdfs/5_1.pdf.

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: Lame's equation – cylinders subjected to inside & outside pressure - compound cylinders.

Learning outcome & Suggested Student Activities:

This unit gives application to mechanics of solids for students in which how to calculate different stresses and strains for the thin and thick cylinders in identifying safe design for boiler shells and thick shells as such in like domestic cylinders, air compressor and high pressure vessels used in thermal plants etc. Notes for this topic can be download from the site

http://www.ewp.rpi.edu/hartford/users/papers/engr/ernesto/poworp/Project/4.%20Supporting_Material/Books/32658_09 & 10.pdf.

Text Books:

1. *Strength of Materials by R.Subramaniam, oxford publishers.*
2. *Strength of Materials by R.K. Bansal, Laxmi Publishers, 5th Edition,2012.*
3. *Mechanics of Materials,Andrews Pytel,Jaan Kiusallaas & M.M.M.Sarcar (Second Edition),Cengage Learning Publishers.*

Reference Books:

1. *Strength of Materials by S. Ramamrutham, Dhanpat Rai Publishers*
2. *Strength of Materials by R.K. Rajput, S.Chand& Company, 5th Edition,2012.*
3. *Strength of Materials by Dr. Sadhu Singh, Khanna Publishers, 10th Edition,2013.*
4. *Strength of Materials by M.Chakraborti, S.K.Kataria& Sons, 2nd Edition,2011.*
5. *Strength of Materials by S S Rattan, The McGraw-Hill Companies, 2nd Editon,2011.*

Suggestions:

- *Students are advised to buy a text book for understanding problems then they may buy Strength of materials by R.K.Bansal, Laxmi Publishers& For further more problems Strength of Materials by R.K. Rajput, S.Chand& Company*
- *Students may go around some of the small scale industries and domestic orientated jobs gives better knowledge on to check strength of materials.*
- *Some basic knowledge regarding Engineering mechanics, Mathematics and Physics are required for understanding this subject.*

Web Resources:

http://nptel.iitm.ac.in/

www.learnerstv.com/Free-Engineering-video-lecture-courses.htm
http://en.wikibooks.org/wiki/Strength_of_Materials

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech II - I sem (M.E)	**T**	**Tu**	**C**
	3	**1**	**3**

(15A03301) ENGINEERING DRAWING FOR MECHANICAL ENGINEERS

Course Objective: To enhance the student's knowledge and skills in engineering drawing of solids with interpenetration of solids and to present isometric and perspective projections.

Unit –I

Sections and Developments of Solids: Section Planes and Sectional View of Right Regular Solids- Prism, cylinder, Pyramid and Cone. True shapes of the sections and their development of Surfaces

Unit –II

Isometric projection: Isometric views of Sectional Planes, and Sectional Solids, Objects.

Unit –III

Conversion of Pictorial views to orthographic views –Conventions.

Unit –IV

Interpenetration of Right Regular Solids: Projections of Curves of intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone, Square Prism Vs Square Prism.

Unit –V

Perspective Projections: Perspective View of Plane Figures and simple Solids, Visual Ray Method, Vanishing point method.

Text Books:

1. *Engineering Drawing, N.D. Bhat, Charotar Publishers*
2. *Engineering Drawing, K.L. Narayana& P. Kannaih, Scitech Publishers, Chennai.*

References:

1. *Engineering Drawing, Johle, Tata McGraw-Hill Publishers,2014*
2. *Engineering Drawing, N.S Patha sarathy, vela murali, Oxford University Press,2015*
3. *Engineering Graphics D.A.Hindoliya, BSP publications, 2014*
4. *Engineering Graphics, K.C.John, PHI,2014*

Suggestions:

Student is expected to buy a book mentioned under 'Text books' for better understanding.
Student should prepare rough sketches for all the problems given at the end of each chapter to improve his / her imaginations.
Student should also practice Auto CAD or any other drawing software to help understanding better.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech II - I sem (M.E)	**T**	**Tu**	**C**
	3	**1**	**3**

(15A03302) ENGINEERING MECHANICS

OBJECTIVE: *This course will serve as a basic course by introducing the concepts of basic mechanics which will help as a foundation to various courses.*

UNIT – I

Introduction of Engineering Mechanics – Basic concepts - System of Forces – Moment of Forces and its Application – Couples and Resultant of Force System – Equilibrium of System of Forces - Degrees of Freedom – Free body diagrams –Types of Supports – Support reactions for beams with different types of loading – concentrated, uniformly distributed and uniformly varying loading.

UNIT – II

Friction : Types of friction– laws of Friction – Limiting friction- Cone of limiting friction– static and Dynamic Frictions – Motion of bodies – Wedge and Screw jack

UNIT – III

Centroid and Center of Gravity: Centroids of simple figures – Centroids of Composite figures – Centre of Gravity of bodies – Area moment of Inertia - Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures.

Mass Moment of Inertia: Moment of Inertia of Simple solids – Moment of Inertia of composite masses.(Simple problems only)

UNIT – IV

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

Kinetics: Analysis as a particle and Analysis as a Rigid Body in Translation – Central Forces of motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies

UNIT – V

Analysis of Perfect Frames: Types of frames – cantilever frames and simply supported frames – Analysis of frames using method of joints, method of sections and tension coefficient method for vertical loads, horizontal loads and inclined loads.

Mechanical Vibrations: Definitions, Concepts-Simple Harmonic motion-Free vibrations-Simple, Compound and Torsional pendulum- Numerical problems

Text Books:

(1) Engineering Mechanics by Jayakumar, Kumar, PHI, 2014
(2) Singer's Engineering Mechanics Statics and Dynamics,Vijay Kumar Reddy, Suresh Kumar. BS Publications 2015
(3) Engineering Mechanics – B. Bhattacharyya, Oxford University Publications, 2015

References:

(1) Engineering Mechanics by Seshigiri Rao, Rama Durgaiah, Universities Press, 2005
(2) Engineering Mechanics by Shames & Rao – Pearson Education.
(3) Engineering Mechanics by Fedrinand L.Singer – Harper Collings Publishers.
(4) Engineering Mechanics (Statics and Dynamics) byPytel, Kiusalaas; Cengage, 2015
(5) Engineering Mechanics by S.Timoshenko, D.H.Young and J.V.Rao, Tata McGraw-Hill Company
(6) Engineering Mechanics by Chandramouli, PHI publications.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

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

T	Tu	C
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(15A03303) THERMODYNAMICS

Course Objective:
By this subject students will get the awareness on basic thermodynamic principles, skills to perform the analysis and design of thermodynamic systems, First law and second law of thermodynamics and its applications to a wide variety of systems, principles of psychrometry and properties of pure substances. And also understand the concept of various air standard cycles with the help of P-v and T-s Diagrams.

UNIT I

BASIC CONCEPTS: Macroscopic and Microscopic Approaches, Thermodynamic System, State, Property, Process and Cycle, Quasi Static Process, Thermodynamic Equilibrium, Quasi-static Process, Zeroth Law of Thermodynamics,

WORK & HEAT TRANSFER: Work transfer, types of work transfers, Point and Path Functions, Heat transfer, Comparison of Work and Heat transfers.

Learning Outcome & Suggested Student Activities:
Students can able to understand thermodynamic property, cycle, constraints of equilibrium, reversibility and energy transfer in the form of Work and Heat with various applications. Students are advised to collect different types of thermometers, measure the temperature of a given room/substance and compare the values. Following URL is very useful for better understanding http://www.nptel.iitm.ac.in. Students may refer text book of Fundamentals of Engineering Thermodynamics By Michael J. Moran, Howard N. Shapiro.

UNIT II

FIRST LAW OF THERMODYNAMICS: First Law applied to a process and a cycle, Energy - a property, Forms and transformation of Energy, Internal Energy and Enthalpy, PMM I.

FLOW SYSTEMS: Control Volume, Steady Flow Process, Mass balance and Energy Balance, Applications of Steady Flow Processes.

Learning Outcome & Suggested Student Activities:
Student will learn how energy transformation occurs from one form into another form in open and closed systems and applying steady flow energy equation and mass balance equation to various applications.
Student is advised to observe the Nozzle, Diffuser, Throttling device, Turbine and compressor in laboratories or local industries and understand their working principles practically. Notes of First law of thermodynamics can be downloaded from the website http://nptel.iitm.ac.in/courses/103101004/downloads/chapter-3.pdf.

UNIT III

Second Law of Thermodynamics: Heat Engine, Statements of Second law and their equivalence, Refrigeration and Heat Pump, Reversibility and Irreversibility, Carnot cycle and Carnot's Theorem, Thermodynamic Temperature Scale, Efficiency of Heat Engine, PMM II

Entropy: Clausius' Theorem, Entropy as a property, T-s Plot, Clausius Inequality, Principle of Entropy Increase and its applications. Available Energy, Quality of Energy, definitions of Dead state, Availability.

Learning Outcome & Suggested Student Activities:
Student will identify the major difference in working of a heat engine, refrigerator and heat pump. to calculate the maximum efficiency of a cycle. Also student can learn calculating entropy change for a process, maximum available energy. Student is advised to visit laboratories of Heat Engines, Refrigeration and Air conditioning and observe how they work. Student may refer text book Fundamentals of Classical Thermodynamics - G.J.VanWylen& Sonntag

UNIT IV

Pure Substances: P-v, P-T, T-s diagrams of Pure Substances, Mollier Diagram, Dryness Fraction, Use of Steam Tables for Thermodynamic Properties

Thermodynamic Relations: Maxwell's equations, TDS equations, Joule-Kelvin Effect, Clausius-clapeyron equation.

Learning Outcome & Suggested Student Activities:

After the completion of the unit, student will be able to understand the method drawing phase equilibrium diagrams like P-v, h-s, T-s and P-T of a pure substance. Student can learn the usage of steam tables and mollier diagrams in solving problems. Also, the student will learn the cooling / heating effect of throttling process. Thermodynamic relations.

Student is advised to do the experiment on water (To cool / heat water) from atmospheric conditions and observe freezing / boiling point temperatures, changes in volume etc. Repeat the same experiment under different pressure.

UNIT V

Properties of Gases and Gas Mixtures: 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 Mixtures

Gas Power Cycles: Carnot Cycle, Sterling Cycle, Ericson Cycle, Otto Cycle, Diesel Cycle, Dual Cycle, their applications, comparison of Otto, Diesel and Dual cycles, Second Law Analysis of Gas Power Cycles

Learning Outcome & Suggested Student Activities:

Student will learn basic laws of ideal gas and gas mixtures. After studying Gas Power Cycles, student will understand the concept of ideal cycles for different engines and their working principle. Student can know drawing P-V and T-S diagrams for various air standard cycles and calculating work output, efficiency, mean effective pressure of each cycle.

Student is advised to conduct experiments in I.C Engines lab to find out the actual thermal efficiencies of Diesel and Petrol Engines and compare them with respect to ideal cycles.

Text Books:

1. *Engineering Thermodynamics, P.K Nag, TMH Publishers, New Delhi, 5th Edition,2013.*
2. *Engineering Thermodynamics by P. Chattopadhya, Oxford,1st Revised ,2016*

Reference Books:

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1. *Thermodynamics for Engineers, Kenneth A. Kroos,Marle C.Potter,V.Pandurangadu.*
2. *Fundamentals of Thermodynamics – Sonntag, Borgnakke and van wylen, John Wiley & sons*
3. *Thermodynamics – An Engineering Approach – YunusCengel& Boles, TMH, 2011.*
4. *Thermodynamics – J.P.Holman, McGrawHill, 2nd Edition company New York 1975.*
5. *An introduction to Thermodynamics, YVC Rao, Universities press, 2009 Revised Edition,*
6. *Engineering Thermodynamics – J.B. Jones & R.E.Dugan, PHI ,1st Edition, 2009.*

NOTE: *Steam tables, Mollier Diagrams should be supplied*

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

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

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(15A01309) MECHANICS OF SOLIDS LABORATORY

MECHANICS OF SOLIDS LAB

1. Direct tension test beam
2. Bending test on
   a) Simply supported beam
   b) Cantilever beam
3. Torsion test
4. Hardness test
5. Brinells hardness test
6. Rockwell hardness test
7. Test on springs
8. Compression test on cube
9. Impact test
10. Punch shear test

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. Tech II - I sem (M.E) **L C**
4 2

(15A03304) COMPUTER AIDED DRAFTING LAB

LIST OF EXPERIMENTS:

I Introduction to Computer Aided Drafting software packages.
II. Practice on basic elements of a Computer Aided Drafting **p**ackages
III. Practice on features of a Computer Aided Drafting **p**ackage
IV Drafting of Solids, Intersection of Solids
V Drafting of Perspective views
VI Drafting of Orthographic views of simple parts

Note: Any of the standard Software Packages like – AUTO CAD, Pro-E, Uni – Graphics, Catia …. Etc may be used

References:

1. Computer – Aided Engineering Drawing, S. Trymbaka Murthy. University Press.
2. Engineering Graphics for Degree, K.C. John. PHI Publications.