**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTHAPURAMU**
**DEPARTMENT OF MECHANICAL ENGINEERING**

# UG SYLLABUS FOR
# R15
# REGULATIONS

**Programme outcomes (POs)**

| | |
|---|---|
| 1 | **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems |
| 2 | **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences |
| 3 | **Design/Development Of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| 4 | **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions |
| 5 | **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
| 6 | **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice |
| 7 | **Environment and Sustain ability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |
| 8 | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| 9 | **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multi disciplinary settings. |
| 10 | **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| 11 | **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi disciplinary environments. |

| | |
|---|---|
| 12 | **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

## Program Specific Outcomes:

| | |
|---|---|
| **PSO 1** | Identify, Formulate and Analyze complex Mechanical Engineering problems |
| **PSO 2** | Ability to implement the learned principles of Mechanical Engineering to Understand, analyze, evaluate and create more advanced mechanical systems or processes. |
| **PSO 3** | Ability to apply Mechanical Engineering Skills and Managerial Skills to Become Entrepreneurs and build the Attitude to innovate. |

**VISION AND MISSION OF THE DEPARTMENT**

**VISION :**

To be a centre of excellence in the field of Mechanical Engineering for providing its students and faculty with opportunities for excel in education and targeted research themes in emerging areas.

**MISSION:**

**M1:** Providing students with sound mechanical engineering knowledge, practices, skills and training

**M2:** Enriching the quality of life of students through teaching, research, internships, outreach programs and symposiums.

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**Course Structure**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**I Year B.Tech. ME-I Semester**

| S.No | Subject Code | SUBJECT | L | P | CREDITS |
|---|---|---|---|---|---|
| 1 | 15A55101 | English | 4 | - | 4 |
| 2 | 15A51101 | Mathematics-I | 4 | - | 4 |
| 3 | 15A01101 | Environmental Studies | 4 | - | 4 |
| 4 | 15A03101 | Engineering Drawing-I | 2 | 4 | 4 |
| 5 | 15A53101 | Engineering Chemistry | 4 | - | 4 |
| 6 | 15A55102 | English Language Communication Skills Lab | - | 4 | 2 |
| 7 | 15A53103 | Engineering Chemistry Lab | - | 4 | 2 |
| 8 | 15A35101 | Engineering Workshop & IT Workshop | - | 4 | 2 |
| | | **Total** | **18** | **16** | **26** |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**I- Year B.Tech. M.E. I-Sem** **L P C**

**4 0 4**

**ENGLISH (15A55101)**

**(Common to All Branches)**

==========

## 1. INTRODUCTION:

English is an international language as well as a living and vibrant one. People have found that knowledge of English is a passport for better career, better pay, advanced knowledge and for communication with the entire world. As it is a language of opportunities in this global age, English is bound to expand its domain of use everywhere. The syllabus has been designed to enhance communication skills of the students of engineering and technology. The prescribed books serve the purpose of preparing them for everyday communication and to face the global competitions in future.

The first text prescribed for detailed study focuses on LSRW skills and vocabulary development. The teachers should encourage the students to use the target language. The classes should be interactive and student-centered. They should be encouraged to participate in the classroom activities keenly.

The text for non-detailed study is meant for extensive reading/reading for pleasure by the students. They may be encouraged to read some select topics on their own, which could lead into a classroom discussion. In addition to the exercises from the texts done in the class, the teacher can bring variety by using authentic materials such as newspaper articles, advertisements, promotional material etc.

| | **COURSE OBJECTIVES** |
|---|---|
| 1 | To enable the students to communicate in English for academic and social purpose |
| 2 | To enable the students to acquire structures and written expressions required for their profession. |
| 3 | To develop and practice critical and evaluative reading |
| 4 | To encourage investigating questions of the humanities through rhetorical study |
| 5 | To enhance the study skills of the students with emphasis on LSRW skills |

**UNIT – I**

**Chapter entitled *Humour* from "Using English"**

**Chapter entitled „*Homi Jehangir Bhabha'* from "New Horizons"**

L- Listening -Techniques - Importance of phonetics
L- Meet & Greet and Leave taking, Introducing Oneself and Others (Formal and Informal situations)
R- -Reading Strategies -Skimming and Scanning
W- Writing strategies- sentence structures
G-Parts of Speech –Noun-number, pronoun-personal pronoun, verb- analysis
V-Affixes-prefix and suffix, root words, derivatives

**UNIT – II**

**Chapter entitled *Inspiration* from "Using English"**

**Chapter entitled „My Struggle for an Education" from "New Horizons"**

L- Listening to details
S- Apologizing, Interrupting, Requesting and Making polite conversations
R-note making strategies
W- Paragraph-types- topic sentences, unity, coherence, length , linking devices
G-Auxiliary verbs and question tags
V- synonyms-antonyms, homonyms , homophones, homographs, words often confused

**UNIT –III**

**Chapter entitled *Sustainable Development* from "Using English"**
**Chapter entitled „The Autobiography of Abraham Lincoln" from "New Horizons"**

L- Listening to themes and note taking
S- Giving instructions and Directions, making suggestions, Accepting ideas, fixing a time and Advising
R- Reading for details -1
W- Resume and cover letter
G- Tenses – Present tense, Past tense and Future tense
V-Word formation and One-Word Substitutes

**UNIT –IV**

**Chapter entitled *Relationships* from "Using English"**

**Chapter entitled „ T*he Happy Prince* from "New Horizons"**

L- Listening to news
S- Narrating stories, Expressing ideas and opinions and telephone skills
R- Reading for specific details and Information
W- Technical Report writing-strategies, formats-types-technical report writing
G- Voice and Subject – Verb Agreement
V- Idioms and prepositional Phrases

**UNIT – V**

**Chapter entitled Science and Humanism from "Using English"**
**Chapter entitled „If" from "New Horizons"**
L- Listening to speeches
S- Making Presentations and Group Discussions
R- Reading for Information
W- E-mail drafting
G- Conditional clauses and conjunctions
V- Collocations and Technical Vocabulary and using words appropriately

## 2. EXPECTED OUTCOME:

The students will get the required training in LSRW skills through the prescribed texts and develop communicative competence

| | **COURSE OUTCOMES** |
|---|---|
| CO1 | Develop facility in responding to a variety of situations and contexts calling for purposeful shifts in voice, tone, level of formality, design, medium, and/or structure |
| CO2 | Become effective in the use of different modes of written communication in a professional environment |
| CO3 | Develop capacity to apply different reading methods to evaluate a mass of data on the net and to glean the necessary information |
| CO4 | Learn and use key rhetorical concepts through analyzing and composing a variety of texts |
| CO5 | Well trained in LSRW skills and develop communicative competence |

## Prescribed Books:

1. **Using English (for detailed study)** published by Orient Black Swan, 2013
2. **New Horizons** published by Pearson, 2013

## SUGGESTED READING:

1. **Raymond Murphy"s English Grammar with CD,** Murphy, Cambridge University Press, 2012.
2. **English Conversation Practice –**Grant Taylor, Tata McGraw Hill, 2009.
3. **Communication Skills, Sanjay Kumar & Pushpalatha** Oxford University Press, 2012.
4. **A Course in Communication Skills**-Kiranmai Dutt & co. Foundation Books, 2012.
5. **Current English grammar and usage**-S M Guptha, PHI, 2013.
6. **Modern English Grammar**-Krishna SWAMI .McMillan, 2009.
7. **Powerful Vocabulary Builder**- Anjana Agarwal New Age International Publishers, 2011.
8. **Writing with a Purpose, Tickoo and Sasi Kumar, OUP, 2011**
9. **Strengthen Your Writing, Orient Blackswan**

## Mapping between Course Outcomes and Programme Outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | 3 | | | | | | 3 | | | | 2 | 1 |
| CO2 | | | | | | | | 3 | | | | | 1 | | 1 |
| CO3 | | | | 3 | | | | | | 3 | | 3 | 1 | 2 | |
| CO4 | | | | | | | | 3 | 3 | | | 3 | 1 | | 1 |
| CO5 | | | | 3 | | | | | | | | | | | |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**I- Year B.Tech. M.E. I-Sem** **L P C**

**4 0 4**

## MATHEMATICS – I (15A51101)

**(Common to All Branches)**

**Objectives**

| | **COURSE OBJECTIVES:** |
|---|---|
| 1 | To train the students thoroughly in Mathematical concepts of ordinary differential equations and their applications |
| 2 | To prepare students for lifelong learning and successful careers using mathematical concepts of differential and Integral calculus, ordinary differential equations and vector calculus. |
| | To develop the skill pertinent to the practice of the mathematical concepts including the students' abilities to formulate and modeling the problems, to think creatively and to synthesize information. |

**UNIT – I**

Exact, linear and Bernoulli equations, Applications to first order equations.

Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type $e^{ax}$, sin ax, cos ax, polynomials in x, $e^{ax}$ V(x), xV(x), method of variation of parameters, linear equations with variable coefficients: Euler-Cauchy Equations, Legendre‟s linear equation. Applications of linear differential equations- Mechanical and Electrical oscillatory circuits and Deflection of Beams.

**UNIT – II**

Taylor‟s and Maclaurin‟s Series - Functions of several variables – Jacobian – Maxima and Minima of functions of two variables, Lagrange‟s method of undetermined Multipliers with three variables only. Radius of curvature, center of curvature, Involutes, evolutes and envelopes..

**UNIT – III**

Curve tracing – Cartesian, polar and parametric curves. Length of curves, surface area of solid of revolution (single integrals)

**UNIT – IV**

Multiple integral – Double and triple integrals – Change of Variables – Change of order of integration. Applications to areas and volumes in Cartesian and polar coordinates using double and triple integral.

**UNIT – V**

Vector Calculus: Gradient – Divergence – Curl and their properties; Vector integration – Line integral - Potential function – Area – Surface and volume integrals. Vector integral theorems: Green‟s theorem – Stoke‟s and Gauss‟s Divergence Theorem (Without proof). Application of Green‟s, Stoke‟s and Gauss‟s Theorems.

| | **COURSE OUTCOMES:** |
|---|---|
| CO1 | The students become familiar with the application of differential and integral calculus, ordinary differential equations and vector calculus to engineering problems. |
| CO2 | The students attain the abilities to use mathematical knowledge to analyze, formulate and solve problems in engineering applications. |

**TEXT BOOKS:**

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

**REFERENCES:**

1. Engineering Mathematics Volume-I, by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publication.
2. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.
3. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
4. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | | 2 | 2 | |
| CO2 | 2 | | | 3 | | | | | | | | | | 2 | 1 |
| CO3 | 2 | 3 | | | | | | | | | | | 2 | 2 | |
| CO4 | | 3 | | | | | | | | | | | | 2 | 1 |
| CO5 | | | 3 | | | | | | | | | | 2 | 2 | 1 |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**DEPARTMENT OF MECHANICAL ENGINEERING**

| **I- Year B.Tech. M.E. I-Sem** | **L** | **P** | **C** |
|---|---|---|---|
| | **4** | **0** | **4** |

**ENVIRONMENTAL STUDIES (15A01101)**

| | **COURSE OBJECTIVES** |
|---|---|
| 1 | To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers. |

**UNIT – I**

**MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES: –** Definition, Scope and Importance – Need for Public Awareness.

**NATURAL RESOURCES :** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

**UNIT – II**

**ECOSYSTEMS :** Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological sucession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**BIODIVERSITY AND ITS CONSERVATION :** Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-soports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

**UNIT – III**

**ENVIRONMENTAL POLLUTION :** Definition, Cause, effects and control measures of :

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

**SOLID WASTE MANAGEMENT :** Causes**,** effects and control measures of urban and industrial wates – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

**UNIT – IV**

**SOCIAL ISSUES AND THE ENVIRONMENT :** From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

**UNIT – V**

**HUMAN POPULATION AND THE ENVIRONMENT :** Population growth, variation among nations. Population explosion – Family Welfare Proggramme. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

**FIELD WORK :** Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds – river, hill slopes, etc..

| | **Course outcomes:** |
|---|---|
| CO1 | Critical thinking: Demonstrate critical thinking skills in relation to environmental affairs. |
| CO2 | Communication: Demonstrate knowledge and application of communication skills and the ability to write effectively in a variety of contexts |
| CO3 | Interdisciplinary synthesis: Demonstrate an ability to integrate the many disciplines and fields that intersect with environmental concerns. |
| CO4 | Ecological literacy: Demonstrate an awareness, knowledge and appreciation of the intrinsic values of ecological processes and communities. |
| CO5 | Sustainability: Demonstrate an integrative approach to environmental issues with a focus an sustainability. |

**TEXT BOOKS** :

(1) Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press.
(2) Environmental Studies by Kaushik, New Age Pubilishers.
(3) Environmental Studies by Benny Joseph, TMH Pubilishers.

**REFERENCES :**

(1) Environmental Studies by Dr.S.Azeem Unnisa, Academic Publishing Company
(2) Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Pubilications.
(3) Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.
(4) Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.
(5) Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Printice hall of India Private limited.
(6) Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | | | | | | | | | | | | | 1 |
| CO2 | | | 3 | | 1 | | 3 | | | | | | | | 1 |
| CO3 | 2 | | | | | | | 3 | | | | 1 | 2 | 2 | |
| CO4 | | | | 3 | 1 | | 3 | | | | | | 2 | | |
| CO5 | | 2 | | | | | | | | | | 1 | | 2 | |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)::ANANTAPURAMU**
**DEPARTMENT OF MECHANICAL ENGINEERING**

| **I- Year B.Tech. M.E. I-Sem** | **L** | **P** | **C** |
|---|---|---|---|
| | **2** | **4** | **4** |

**ENGINEERING DRAWING-I (15A03101)**
**(MECHANICAL)**

| **Course Objectives:** To impart knowledge on | |
|---|---|
| C2 02.1 | To impart knowledge on Representing any matter/object with the help of picture. |
| C2 02.2 | To impart knowledge on Working drawings |
| C2 02.3 | To impart knowledge on Orthographic drawing of different machine parts. |
| C2 02.4 | To impart knowledge on Developing assembly drawings. |
| C2 02.5 | To impart knowledge on Developing assembly drawings |

**UNIT-I**

Introduction to Engineering Drawing: Principles of Engineering Graphics and their significance Drawing Instruments and their Use – BIS Conventions in drawing and Lettering.

Curves used in practice:

a) Conic sections including the Rectangular Hyperbola
b) Cycloid, Epicycloid and Hypocycloid –normals and Tangents
c) Involute of a circle –Normals and Tangents
d) Helices –multi start on cylinder and cone

**UNIT –II**

Principles of orthographic projections – First and Third angle projections Projection of points. Projections of lines inclined to one plane.

**UNIT –III**

Projection of lines inclined to both reference planes – traces.

**UNIT –IV**

True length, true angles of projected lines –use of auxiliary planes –profile view, point view. Projection of regular planes inclined to both planes, true shapes.

**UNIT –V**

Projection of solids inclined to both planes.

| | |
|---|---|
| | **Course Outcomes:**<br>After the completion of the course, |
| CO1 | The student will be able to understand the principles of drawing,uses of drawing instruments and able to draw curves in conic section. |
| CO2 | The student will be able to draw orthographic projections and projection of point and lines |
| CO3 | They can able to draw the projection of lines inclined to both the planes. |
| CO4 | They can able to determine the true length and angle of projected lines |
| CO5 | They can able to draw the projection of solids inclined to both the planes |

**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.
2. Engineering Drawing, Shah and Rana,2/e, Pearson Education
3. Engineering Drawing and Graphics, Venugopal/New age Publishers
4. Engineering Graphics, John&john.

***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.*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 3 | 2 | | | 2 | 1 | 1 | | | 1 | | 2 | |
| CO2 | | 3 | | | | | 2 | 1 | | | | | 3 | | 3 |
| CO3 | 2 | | 3 | 2 | | | | 1 | 1 | 2 | | 1 | | 2 | 3 |
| CO4 | | 3 | | 2 | | | 2 | 1 | | | | | 3 | | 3 |
| CO5 | 2 | 3 | 3 | 2 | | | 2 | 1 | 1 | | | 1 | | 2 | |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**DEPARTMENT OF MECHANICAL ENGINEERING**

| **I- Year B.Tech. M.E. I-Sem** | **L** | **P** | **C** |
|---|---|---|---|
| | **4** | **0** | **4** |

**ENGINEERING CHEMISTRY (15A53101)**

**(Common to C.E, ME)**

**Knowledge in chemistry serves as basic nutrient for the understanding and thereby design of materials of importance in life. Thus the advancement in Engineering is depend on the outcome of basic sciences. Many advances in engineering either produce a new chemical demand as in the case of polymers or wait upon chemical developments for their applications as in the case of implants and alloys. Currently the electronics and computer engineers are looking forward for suitable biopolymers and nano materials for use in miniature super computers, the electrical materials engineers are in search of proper conducting polymers, the mechanical engineers are on lookout for micro fluids and the civil engineers are looking for materials that are environmental friendly, economical but long lasting.**

| **COURSE OBJECTIVES** | |
|---|---|
| 1 | The Engineering Chemistry course for undergraduate students is framed to strengthen the fundamentals of chemistry and then build an interface of theoretical concepts with their industrial/engineering applications. |
| 2 | The course main aim is to impart in-depth knowledge of the subject and highlight the role of chemistry in the field of engineering. |
| 3 | The lucid explanation of the topics will help students understand the fundamental concepts and apply them to design engineering materials and solve problems related to them. An attempt has been made to logically correlate the topic with its application. |
| 4 | The extension of fundamentals of electrochemistry to energy storage devices such as commercial batteries and fuel cells is one such example |

## UNIT.1
## ELECTROCHEMISTRY

i).Review of electrochemical cells, Numerical calculations, Batteries: Rechargeable batteries (Lead acid, Ni-Cd, Lithium Ion Batteries), Fuels cells: (Hydrogen-Oxygen and Methanol-Oxygen)

ii).Electrochemical sensors: Potentiometric Sensors and voltammetric sensors. Examples: analysis of Glucose and urea

iii).Corrosion: definition, Types of Corrosion: Dry Corrosion (Direct Chemical attack), Wet Corrosion, Electrochemical Theory of corrosion, Factors affecting the corrosion. Prevention: Anodic and catholic protection and electro and electroless plating. (10h)

## UNIT.2
## POLYMERS

i).Introduction to polymers, Polymerisation process, mechanism:cationic, anionic, free radical and coordination covalent.

Elastomers

Natural Rubber; Compounding of Rubber

Synthetic Rubber: Preparation, properties and engineering applications of Buna-S, buna-N, Polyurethene, Polysulfide (Thiokol) rubbers

Plastomers: Thermosetting and Thermoplatics, Preparation, properties and Engineering applications , PVC, Bakelite, nylons. Elastomers (rubbers)

ii).Conducting polymers: Mechanism, synthesis and applications of polyacetyline, polyaniline.

iii).Liquid Crystals: Introduction, classification and applications

iii).Inorganic Polymers: Basic Introduction, Silicones, Polyphospazins (-(R)2-P=N-) applications.(12h)

## UNIT.3
## FUEL TECHNOLOGY

i).Classifications of Fuels – Characteristics of Fuels- Calorific Value – Units, Numerical Problems.Solid Fuels–Coal, Coke : Manufacture of Metallurgical Coke by Otto Hoffmann‟s by product oven processes.

ii).Liquid Fuels:Petroleum: Refining of Petroleum, Gasoline: Octane Number, Synthetic Petrol: Bergius Processes, Fischer Troph‟s synthesis

Power Alcohol: Manufacture, Advantages and Disadvantages of Power Alcohol

iii). Gaseous Fuels: Origin, Production and uses of Natural gas, Producer gas, Water gas, Coal gas and Biogas. Flue Gas analysis by Orsat‟s apparatus, Solving of problems on Combustion. (12h)

**UNIT.4**

**CHEMISTRY OF ENGINEERING MATERIALS**

i).Ceramic: General properties, classification.

ii).Glass: Manufacture of glass, properties of glass, fracture of glasses, types of glasses.

iii).Cement: Composition, Setting and Hardening (Hydration and Hydrolysis)

iv).Refractories: Classification, properties and applications

v).Lubricants: Theory of lubrication, properties of lubricants and applications

vi). Rocket Propellants: Classification, Characteristics of good propellant. (9h)

**UNIT.5**

**WATER TREATMENT**

Impurities in water, Hardness of water and its Units, Disadvantages of hard water, Estimation of hardness by EDTA method, Numerical problems on hardness, Estimation of dissolved oxygen, Alkalinity, acidity and chlorides in water, Water treatment for domestic purpose (Chlorination, Bleaching powder, ionisation)

Industrial Use of water:

For steam generation, troubles of Boilers: Scale & Sludge, Priming and Foaming, Caustic Embrittlement and Boiler Corrosion.

Treatment of Boiler Feed water:

Internal Treatment: Colloidal, Phosphate, Carbonate, Calgon and sodium aluminate treatment.

External Treatment: Ion-Exchange and Permutit processes.

Demineralisation of brackish water: Reverse Osmosis and Electro dialysis (12h)

******

| | **COURSE OUTCOMES** |
|---|---|
| CO1 | The students would understand about the concepts of chemistry in respect of Electrochemical cells, fuel cells, mechanism of corrosion and factors to influence, polymers with their applications, engineering materials and water chemistry. |
| CO2 | Understand industrially based polymers, various engineering materials. |
| CO3 | Differentiate between hard and soft water. Understand the disadvantages of using hard water domestically and industrially. The Students select and apply suitable treatments domestically and industrially. |
| CO4 | They can able to know the chemical properties of engineering materials like ceramics, cement, glass, refractories, rocket propellants, lubricants. |

| | |
|---|---|
| CO5 | Understanding the water treatment to reduce the impurities, corrosion of boiler, Internal and external treatment of water. |

**Text Books:**

1. Engineering Chemistry by KNJayaveera, GVSubba Reddy and C. Ramachandraiah, McGraw Hill Higher Education, Foruth Edition, New Delhi
2. A Text Book of Enigneering Chemistry, Jain and Jain, Dhanapathi Rai Publications, New Delhi

**References:**

1.A Text book of Engineering Chemistry by SS Dhara, S. Chand Publications, New Delhi
2. Engineering Chemistry by K.B.Chandra Sekhar, UN.Das and Sujatha Mishra, SCITECH Pubblications India Pvt Limited.
3. Concepts of Engineering Chemistry- Ashima Srivastavaf and N.N. Janhavi
4. Text Book of Engineering Chemistry – C. Parameswara Murthy, C.V.Agarwal and Andra Naidu
5. Chemistry of Engineering Materials, C.V.Agarwal, C.Parameswaramurthy and Andranaidu
6. Text Book of Engineering Chemistry, Shashichawla, Dhanapathirai Publications.

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | 1 | | 3 | | | | | | | | | |
| CO2 | | 2 | 3 | | | | | | | | | | 1 | 2 | 3 |
| CO3 | | | | 1 | 2 | | | | | | | | | | |
| CO4 | | 2 | | | | 3 | 3 | | | | | | 1 | 2 | 3 |
| CO5 | | | 3 | | | | | | | | | | | | |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**DEPARTMENT OF MECHANICAL ENGINEERING**

| **I- Year B.Tech. M.E. I-Sem** | **L** | **P** | **C** |
|---|---|---|---|
| | **0** | **4** | **2** |

## ENGLISH LANGUAGE COMMUNICATION SKILLS (ELCS) LAB (15A55102)

The **Language Lab** focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

| **COURSE OBJECTIVES** | |
|---|---|
| 1 | To facilitate computer-aided multi-media instruction enabling individualized and independent language learning |
| 2 | To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm |
| 3 | To provide opportunities for practice in using English in day to day situations |
| 4 | To improve the fluency in spoken English and neutralize mother tongue influence |
| 5 | To train students to use language appropriately for debate, group discussion and public speaking |

**SYLLABUS:**

**UNIT- I**

**Phonetics – Introduction to Sounds of Speech – Vowels – Consonants – Phonetic Transcription & Orthographic Transcription**

**UNIT – II**

**Syllabification – Word Stress – Rules of word stress – Intonation – Falling tone and Rising tone**

**UNIT – III**

**Situational Dialogues – Role-play – Expressions in various situations – Self Introduction – Introducing others – Greetings – Apologies – Requests – Social and Professional etiquettes – Telephone Etiquettes**

**UNIT – IV**

**JAM – Describing object/person/place/situation – Giving directions**

**UNIT – V**

**Debates and Group Discussions**

**EXPECTED OUTCOMES**:

- Becoming active participants in the learning process and acquiring proficiency in spoken English of the students
- Speaking with clarity and confidence thereby enhancing employability skills of the students

**MINIMUM REQUIREMENT FOR ELCS 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. 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. Walden Infotech English Language Communication Skills.
2. Clarity Pronunciation Power – Part I (Sky Pronunciation)
3. Clarity Pronunciation Power – part II
4. K-Van Advanced Communication Skills
5. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
6. *DELTA's key to the Next Generation TOEFL Test: Advanced Skills Practice.*
7. Lingua TOEFL CBT Insider, by Dreamtech
8. English Pronunciation in Use (Elementary, Intermediate, Advanced) CUP
9. Cambridge Advanced Learners" English Dictionary with CD.

| | COURSE OUTCOMES |
|---|---|
| CO1 | Better Understanding of nuances of language through audio- visual experience and be independent learners |
| CO2 | The significance of paralinguistic features will be understood by the students and they will try to be intelligible. |
| CO3 | Become good at Inter-personal skills |
| CO4 | Achieve neutral accent and be free from mother tongue influence |
| CO5 | Being an active participant in debates and group discussion, showing ability to express agreement, argument to summarize ideas to elicit the views of others and present own ideas; |

## REFERENCE BOOKS:

1. **A Textbook of English Phonetics for Indian Students** 2nd Ed T. Balasubramanian. (Macmillian), 2012.
2. **A Course in Phonetics and Spoken English**, Dhamija Sethi, Prentice-Hall of India Pvt.Ltd
3. **Speaking English Effectively**, 2nd Edition Krishna Mohan & NP Singh, 2011. (Mcmillan).
4. **A Hand book for English Laboratories**, E.Suresh kumar, P.Sreehari, Foundation Books,2011
5. **English Pronunciation in Use. Intermediate & Advanced**, Hancock, M. 2009. CUP
6. **Basics of Communication in English**, Soundararaj, Francis. 2012.. *New Delhi: Macmillan*
7. **Spoken English** (CIEFL) in 3 volumes with 6 cassettes, OUP.
8. **English Pronouncing Dictionary**, Daniel Jones Current Edition with CD.Cambridge, 17th edition, 2011.

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | 3 | | | | | | 2 |
| CO2 | | | | | | | | | 3 | 3 | | 3 | | | |
| CO3 | | | | | | | | | | | | | | 1 | |
| CO4 | | | | | | | | | 3 | 3 | | | 1 | | 2 |
| CO5 | | | | | | | | | | | | | | | |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**DEPARTMENT OF MECHANICAL ENGINEERING**

| **I- Year B.Tech. M.E. I-Sem** | **L** | **P** | **C** |
|---|---|---|---|
| | **0** | **4** | **2** |

## ENGINEERING CHEMISTRY LAB (15A53103)

The experiments are designed in a manner that the students can validate their own theory understanding in chemistry by self involvement and practical execution. Thus the execution of these experiments by the student will reinforce his/her understanding of the subject and also provide opportunity to refine their understanding of conceptual aspects. As a result, the student gets an opportunity to have feel good factor at the laboratory bench about the chemical principles that he/she learned in the classroom.

| | **COURSE OBJECTIVES** |
|---|---|
| 1 | Will learn practical understanding of the redox reaction |
| 2 | Will able to understand the function of fuel cells, batteries and extend the knowledge to the processes of corrosion and its prevention |
| 3 | Will learn the preparation and properties of synthetic polymers and other material that would provide sufficient impetus to engineer these to suit diverse applications |
| 4 | Will also learn the hygiene aspects of water would be in a position to design methods to produce potable water using modern technology |

**LIST OF EXPERIMENTS**

1. Determination of total hardness of water by EDTA method.
2. Determination of Copper by EDTA method.
3. Estimation of Dissolved Oxygen by Winkler‟s method
4. Determination of Copper by Iodometry
5. Estimation of iron (II) using diphenylamine indicator (Dichrometry – Internal indicator method).
6. Determination of Alkalinity of Water
7. Determination of acidity of Water
8. Preparation of Phenol-Formaldehyde (Bakelite)
9. Determination of Viscosity of oils using Redwood Viscometer I
10. Determination of Viscosity of oils using Redwood Viscometer II
11. Conductometric titration of strong acid Vs strong base (Neutralization titration).
12. Conductometric titration of Barium Chloride vs Sodium Sulphate (Precipitation Titration)
13. Determination of Corrosion rate and inhibition efficiency of an inhibitor for mild steel in hydrochloric acid medium.

14. Estimation of Chloride ion using potassium Chromite indicator (Mohrs method)

(Any 10 experiments from the above list)

| | **COURSE OUTCOMES** |
|---|---|
| CO1 | Would be confident in handling energy storage systems and would be able combat chemical corrosion |
| CO2 | Would have acquired the practical skill to handle the analytical methods with confidence. |
| CO3 | Would feel comfortable to think of design materials with the requisite properties |
| CO4 | Would be in a position to technically address the water related problems. |
| CO5 | Determine viscosity, pH, acidity, corrosion of water |

**TEXT BOOKS:**

**1.** Engineering Chemistry by KNJayaveera, GVSubba Reddy and C. Ramachandraiah, McGraw Hill Higher Education, Foruth Edition, New Delhi
**2.** A Text book of Engineering Chemistry by SS Dhara, S. Chand Publications, New Delhi

**REFERENCES:**

1. A Text Book of Enigneering Chemistry, Jain and Jain, Dhanapathi Rai Publications, New Delhi
2. Engineering Chemistry by K.B.Chandra Sekhar, UN.Das and Sujatha Mishra, SCITECH Pubblications India Pvt Limited.
3. Concepts of Engineering Chemistry- Ashima Srivastavaf and N.N. Janhavi
4. Text Book of Engineering Chemistry – C. Parameswara Murthy, C.V.Agarwal and Andra Naidu
5. Chemistry of Engineering Materials, C.V.Agarwal, C.Parameswaramurthy and Andranaidu
6. Text Book of Engineering Chemistry, Shashichawla, Dhanapathirai Publications.

**TEXT BOOKS:**

1. Vogel's Text book of Quantitative Chemical Analysis, Sixth Edition – J. Mendham et al, Pearson Education.
2. Chemistry Practical – Lab Manual by Chandra Sekhar, GV Subba Reddy and Jayaveera.

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | 3 | | | | | | | | | 2 | | |
| CO2 | 2 | | | | | 2 | | | | | | | | 2 | 1 |
| CO3 | | | | 3 | 1 | | | | | | | | | 2 | |
| CO4 | 2 | | 3 | | 1 | 2 | | | | | | | 2 | 2 | 1 |
| CO5 | | | 3 | 3 | | | | | | | | | | | |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**I- Year B.Tech. M.E. I-Sem** **L P C**

**0 4 2**

**ENGINEERING WORKSHOP& IT WORKSHOP LAB (15A35101)**

**Part-A**

**ENGINEERING WORKSHOP**

# (Common to All Branches)

| | **COURSE OBJECTIVES** |
|---|---|
| 1 | The objective of this subject is to provide the basic concepts about the engineering workshop trades like Carpentry, Fitting etc. |
| 2 | Gain knowledge of the use of various workshop tools and make models in the respective trades. |
| 3 | Exposure to power tools |

**1. TRADES FOR EXERCISES:**

**At least 2 exercise In each:**

1. Carpentry
2. Fitting
3. House-wiring
4. Black Smithy
5. Tin smithy
6. Power Tools Demonstration

| **Course Outcomes** | |
|---|---|
| CO1 | Student will be aware of the safety aspects in using the tools |
| CO2 | Student will be able to use the tools for the preparation of models in respective trades of engineering workshop. |
| CO3 | Precautions in making the models will be known by the student. |
| CO4 | Student will be aware of the usage of the power tools for various purposes. |
| CO5 | Knowledge about the measuring instruments will be achieved. |

**TEXT BOOK:**

1. Work shop Manual / P.Kannaiah/ K.L.Narayana/ Scitech Publishers.

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | 2 | | | 3 | | | 2 | | 3 | |
| CO2 | | | 2 | | | | | | | | | | | | |
| CO3 | | 3 | | | 3 | | 1 | | | | 2 | 2 | | | |
| CO4 | | | | 2 | | | 1 | | | | 2 | | 2 | 3 | 2 |
| CO5 | 3 | | 2 | | | | | | 3 | | | 2 | | | 2 |

Codes / Tables : Nil

Question Paper pattern : Test in any two out of 6 trades.

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**I- Year B.Tech. M.E. I-Sem**

# IT Workshop
# (Common to All Branches)

**PART – B (IT Workshop)**

| COURSE OBJECTIVES | |
|---|---|
| 1 | To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations |
| 2 | To make the students know about the internal parts of a computer, assembling a computer from the parts, preparing a computer for use by installing the operating system |
| 3 | To learn about Networking of computers and use Internet facility for Browsing and Searching |

**Preparing your Computer**

**Task 1: Learn about Computer:** Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

**Task 2: Assembling a Computer:** Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods available (eg: beeps). Students should record the process of assembling and trouble shooting a computer.

**Task 3: Install Operating system:** Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

**Task 4**: **Operating system features**: Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process.

**Networking and Internet**

**Task 5: 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. **Task 6: Browsing Internet**: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e- mail account and send email. They should get acquaintance with applications like Facebook, skype etc.

If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, search process using different natural languages, and creating e-mail account.

**Task 7: Antivirus:** Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc.

**Productivity tools**

**Task 8: Word Processor:** Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered.

**Task 9: Spreadsheet:** 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 10: Presentations:** creating, opening, saving and running the presentations, Selecting the style for slides, formatting the slides with different fonts, colours, 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.

| | **COURSE OUTCOMES** |
|---|---|
| CO1 | Disassemble and Assemble a Personal Computer and prepare the computer ready to use |
| CO2 | Prepare the Documents using Word processors and Prepare spread sheets for calculations using excel |
| CO3 | Prepare Slide presentations using the presentation tool |
| CO4 | Interconnect two or more computers for information sharing |
| CO5 | Access the Internet and Browse it to obtain the required information |

**References:**

1. Introduction to Computers, Peter Norton, Mc Graw Hill
2. MOS study guide for word, Excel, Powerpoint & Outlook Exams", Joan Lambert, Joyce Cox, PHI.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI
5. Trouble shooting, Maintaining & Repairing PCs", Bigelows, TMH

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | 2 | | | | | | 3 | | 2 | 3 | |
| CO2 | 3 | | | | | | | | | | | | | | |
| CO3 | 3 | 2 | 3 | | 2 | | | | 2 | | | | | | 2 |
| CO4 | | | | | | | | | | 2 | | 2 | 2 | | |
| CO5 | | | | 2 | | 1 | | | 2 | 2 | | | | | 2 |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**Course Structure**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**I Year B.Tech ME- II Semester**

| S.No | | SUBJECT | L | P | CREDITS |
|---|---|---|---|---|---|
| 1 | 15A55201 | Technical Communication and Presentation Skills | 4 | - | 4 |
| 2 | 15A51201 | Mathematics –II | 4 | - | 4 |
| 3 | 15A05201 | Problem solving and Computer Programming | 4 | - | 4 |
| 4 | 15A52201 | Engineering Physics | 4 | - | 4 |
| 5 | 15A03201 | Engineering Drawing-II | 2 | 4 | 4 |
| 6 | 15A01202 | Engineering Mechanics | 4 | - | 4 |
| 7 | 15A05202 | Computer programming Lab | - | 4 | 2 |
| 8 | 15A52202 | Engineering Physics Lab | - | 4 | 2 |
| | | **Total** | **22** | **12** | **28** |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**DEPARTMENT OF MECHANICAL ENGINEERING**

| **I- Year B.Tech. M.E. II-Sem** | **L** | **P** | **C** |
|---|---|---|---|
| | **4** | **0** | **4** |

**TECHNICAL COMMUNICATION & PRESENTATION SKILLS (15A55201)**

PREAMBLE:

In the increasingly globalized world, technical communication and presentation skills are assuming great importance. Industries and employers constantly complain that young engineers have adequate technical knowledge, but no communication and presentation skills. Success is defined these days in terms of possessing these skills. The syllabus has been designed to develop communicative competencies of the students.

| | **COURSE OBJECTIVES** |
|---|---|
| 1 | To develop awareness in students of the relevance and importance of technical communication and presentation skills. |
| 2 | To prepare the students for placements |
| 3 | To sensitize the students to the appropriate use of non-verbal communication |
| 4 | To train students to use language appropriately for presentations and interviews |
| 5 | To enhance the documentation skills of the students with emphasis on formal and informal writing |

**UNIT 1:**

Basics of Technical Communication – Introduction – Objectives & Characteristics of Technical Communication – Importance and need for Technical communication - LSRW Skills – Barriers to effective communication

**UNIT II**

Informal and Formal Conversation - Verbal and Non-verbal communication –Kinesics, Proxemics, Chronemics, Haptics, Paralanguage

**UNIT III**

Written communication – Differences between spoken and written communication – Features of effective writing –Advantages and disadvantages of spoken and written communication

**UNIT IV**

Presentation Skills – Nature and importance of oral presentation – Defining the purpose – Analyzing the audience - Planning and preparing the presentation, organizing and rehearsing the presentation –Individual and group presentations - Handling stage fright

**UNIT V**

Interview Skills – The Interview process –Characteristics of the job interview – Pre-interview preparation techniques – Projecting the positive image – Answering Strategies

**OUTCOME**

Turning out the students with a clear concept of communication and presentation skills, getting them ready for placements and equipping them with readiness to implement them at work place.

| | **COURSE OUTCOMES** |
|---|---|
| CO1 | Become effective technical communicators |
| CO2 | Be job-ready and able to face interviews confidently |
| CO3 | Sensitive use of non-verbal language suitable to different situations in professional Life |
| CO4 | Learn and use keys words, phrases and sentence structures making a mark in interviews and presentation skills |
| CO5 | Effective writing skills with the ability to use different styles for different situations |

**Prescribed Books**

1. **Effective Technical Communication,** Ashrif Rizvi, TataMcGrahill, 2011
2. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, O U Press 2009

**Reference Books**

**1.Communication Skills by Pushpalatha & Sanjay Kumar, Oxford Univsesity Press**

**2.**Books on **TOEFL/GRE/GMAT/CAT/ IELTS** by Barron‟s/DELTA/Cambridge University Press.2012.

**3. Soft Skills for Everyone,** Butterfield Jeff, Cengage Publications, 2011.

**4. Management Shapers Series** by Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.

**5. Handbook for Technical Writing** by David A McMurrey & Joanne Buckely CENGAGE Learning 2008.

**6.English for Technical Communication for Engineering Students, Aysha Vishwamohan,**

**Tata Mc Graw-Hill 2009.**

**JNTACEA** **R-15**

**2015-16**

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | | | | 2 |
| CO2 | | | | | | | | | 3 | | | | | | 2 |
| CO3 | | | | | | | | | | 3 | | 3 | 1 | | 2 |
| CO4 | | | | | | | | | 3 | | | | | | 2 |
| CO5 | | | | | | | | | 3 | | | 3 | | 1 | |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**DEPARTMENT OF MECHANICAL ENGINEERING**

| **I- Year B.Tech. M.E. II-Sem** | **L** | **P** | **C** |
|---|---|---|---|
| | **4** | **0** | **4** |

**MATHEMATICS – II (15A51201)**
**(Common to All Branches)**

| | **COURSE OBJECTIVES:** |
|---|---|
| 1 | To impart basic knowledge on Fourier series, Fourier transforms, Laplace Transforms, z-transforms and partial differential equations. |
| 2 | To develop skills in analyzing the problems, designing mathematical models, Fourier series, Fourier transforms, Laplace transforms, z-transforms and partial differential equations for the problems in engineering. |

**UNIT – I**

Laplace transform of standard functions – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shifting theorem – Dirac‟s delta function – Convolution theorem – Laplace transform of Periodic function. Differentiation and integration of transform – Application of Laplace transforms to ordinary differential equations of first and second order.

**UNIT – II**

Fourier Series: Determination of Fourier coefficients – Fourier series – Even and odd functions – Fourier series in an arbitrary interval – Even and odd periodic continuation – Half-range Fourier sine and cosine expansions- Parseval‟s formula- Complex form of Fourier series.

**UNIT – III**

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

**UNIT – IV**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Method of separation of variables – Solutions of one dimensional wave equation, heat equation and two-dimensional Laplace‟s equation under initial and boundary conditions.

**UNIT – V**

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

| **COURSE OUTCOMES:** After completion of the course a successful student is able to | |
|---|---|
| CO1 | Acquire basic knowledge in<br>(a) Fourier series and Fourier transforms<br>(b) Fourier integrals<br>(c) Laplace transforms and their applications<br>(d) z- transforms and their applications<br>(e) Solving partial differential equations<br>(f) Heat transfer and wave motion |
| CO2 | Develop skills in Analyzing the<br>(a) Properties of Fourier series for a given function<br>(b) Partial differential equations through different evaluation methods<br>(c) Difference equations through z – transforms<br>(d) Engineering systems and processes involving wave forms and heat transfer |
| CO3 | Develop skills in designing mathematical models for<br>(a) Problems involving heat transfer and wave forms<br>(b) Engineering concepts involving, Fourier transforms, Fourier integrals,<br>(c) Laplace transforms, z-transforms and difference equations |
| CO4 | Develop analytical skills in solving the problems involving<br>(a) Fourier series and Fourier transforms<br>(b) Laplace transforms<br>(c) Z-transforms and difference equations<br>(d)Heat transfer and wave motion |
| CO5 | Use relevant transformation techniques for<br>(a) Obtaining Fourier transforms for different types of functions<br>(b) Laplace transforms<br>(c) Z- transforms<br>(d) Partial differential equations |

**TEXT BOOKS:**

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Engineering Mathematics, Volume - II, E. Rukmangadachari Pearson Publisher.

**REFERENCES:**

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

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 3 | | | | | | | | | | | 1 | | |
| CO2 | 3 | | | | | | | | | | | | | 1 | |
| CO3 | | 3 | | | | | | | | | | | 1 | 1 | |
| CO4 | 3 | | | | 3 | | | | | | | | | | |
| CO5 | | 3 | 3 | | 3 | 3 | | | | | | | 1 | | |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**DEPARTMENT OF MECHANICAL ENGINEERING**

| **I- Year B.Tech. M.E. II-Sem** | **L** | **P** | **C** |
|---|---|---|---|
| | **4** | **0** | **4** |

# Problem solving and Computer Programming (15A05201)

# (Common to All Branches)

| **COURSE OBJECTIVES** | |
|---|---|
| 1 | To understand the various steps in Program development |
| 2 | To understand the basic concepts in C Programming Language |
| 3 | To learn how to write modular and readable C Programs |
| 4 | To understand the basic concepts such as Abstract Data Types, Linear and Non Linear Data structures. |
| 5 | To understand the notations used to analyze the Performance of algorithms. |
| 6 | To understand and analyze various searching and sorting algorithms |

**UNIT - I**

**Introduction:** Programs and Programming, Programming Languages, Compiler, Interpreter, Loader and Linker, Program Execution, Classification of Programming, Structured Programming Concept, Algorithms, Flowcharts, System Developments.

**Fundamentals Algorithms:** Exchange the Values between two variables, Counting, Summation of set of numbers, Factorial Computation, Generation of the Fibonacci sequence, Reversing the digits of a integer.

**Basics Of C:** Introduction**,** Developing Programs in C, A Simple C program, Parts of C Program Revisited.

**UNIT – II**

**Structure of C:** Structure of a C Program, Concept of a Variable, Data Types in C, Program Statements, Declaration, Tokens, Operators and Expressions, Type conversion in C.

**Input and Output:** Introduction, Basic Screen and Keyboard I/O in C, Non-Formatted Input and Output, Formatted Input and Output Function.

**Control Statements:** Introduction, Specifying Test Condition for Selection and Iteration, Writing Test Expression, Conditional Execution and Selection, Iteration and Repetitive Execution. Nested Loops.

**UNIT – III**

**Arrays And Strings:** Introduction, One-Dimensional Array, Strings, Multidimensional Arrays, Arrays of Strings.

**Function:** Introduction, Concept of Functions, Using Functions, Call by Value Mechanism, Working with Functions, Passing Arrays to Functions, Scope and Extent, Inline Function, Recursion.

**UNIT - IV**

**Factoring Methods:** Finding Square root of a Number, The Smallest Deviser of an Interger, The GCD of Two Integers, Generating Prime Numbers.

**Pointers** – Introduction, Understanding Memory, Address Operator, Pointer, Void Pointer, Null Pointer, Use of pointer, Arrays and Pointers, Pointers and string, Pointers and string, Pointers to pointers, Array of pointers, Pointers to Function, Dynamic Memory Allocation,.

**UNIT – V**

**User-Defined Data Types and Variables:** Introduction, User-defined Data Types, Structures, Union, Enumeration Types.

**Files in C:** Introduction, Using Files in C, Working with text Files, Working with Binary Fields, Direct File Input and Output, Files of Records, Random Access to Files of Records.

| **COURSE OUTCOMES** | |
|---|---|
| CO1 | Able to design the flowchart and algorithm for real world problems |
| CO2 | Able to learn and understand new programming languages |
| CO3 | Able to construct modular and readable programs |
| CO4 | Able to write C programs for real world problems using simple and compound data types |
| CO5 | Adapt programming experience and language knowledge to other programming language contexts |

**TEXT BOOKS:**

1. Programming in C, Pradip Dey, Manas Ghosh, Second Edition, OXFORD,
2. How to Slove it by Computer by R.G. Dromey, Pearson.

**REFERENCES:**

1. Programming in C and Data Structures, Jeri R. Hanly, Elliot B. Koffman, Ashok Kamthane and A.Ananda Rao, Pearson Education.

2. C Programming with problem solving, J.A. Jones & K. Harrow, dreamtech Press
3. Programming In C, Remma Teraja, Second Edition OXFORD.
3 Programming in C – Stephen G. Kochan, III Edition, Pearson Eductaion.
3. C for Engineers and Scientists, H.Cheng, Mc.Graw-Hill International Edition
4. Education / PHI
5. C Programming & Data Structures,E.Balagurusamy,TMH.

## Mapping between Course Outcomes and Programme Outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | | 1 | | 1 | | 3 | | | 3 | | | |
| CO2 | | | 3 | | | 2 | | 1 | | 1 | 2 | | 2 | 1 | |
| CO3 | | | 3 | 3 | | | | 1 | | | | | | | 3 |
| CO4 | | 2 | | | | | 3 | | 3 | 1 | 2 | | 2 | | |
| CO5 | 1 | | | | 1 | | | | | 1 | | | | | |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**DEPARTMENT OF MECHANICAL ENGINEERING**

| I-B.Tech. II SEM | T | P | C |
|---|---|---|---|
| | 0 | 3 | 3 |

# Engineering Physics

| | **COURSE OBJECTIVES** |
|---|---|
| 1 | To make a bridge between the physics in school and engineering courses. |
| 2 | To evoke interest on applications of superposition effects like interference and diffraction, the mechanisms of emission of light, achieving amplification of electromagnetic radiation through stimulated emission, study of propagation of light through transparent dielectric waveguides along with engineering applications. |
| 3 | To open new avenues of knowledge in dielectric and magnetic materials which find potential in the emerging micro device applications. |
| 4 | To understand and employ the concepts of waves & oscillations and acoustics to engineering applications. |
| 5 | To give an impetus on the subtle mechanism of superconductors using the concept of BCS theory and their fascinating applications. Considering the significance of micro miniaturization of electronic devices and significance of low dimensional materials, the basic concepts of nano and smart materials, their properties and applications in modern emerging technologies are elicited. |
| 6. | To enlighten the characterization of materials by different techniques, the periodic arrangement of atoms in crystals, Bragg's law and X-Ray diffraction technique. |

## UNIT 1: PHYSICAL OPTICS, LASERS AND FIBRE OPTICS

***Physical Optics****:* Introduction to interference – Colours in thin films – Newton‟s Rings – Michelson interferometer - Fraunhoffer diffraction due to single slit, double slit – Diffraction grating.

***Lasers****:* Introduction – Characteristics of laser – Spontaneous and stimulated emission of radiation –- Einstein‟s coefficients — Population inversion – Pumping mechanisms - Ruby laser – He-Ne laser – Applications of lasers.

**Fiber optics**: Introduction – working principle of optical fiber – Numerical aperture and acceptance angle – Types of optical fibers –Optical fiber communication system – Attenuation and losses in optical fibers – Applications of optical fibers.

**UNIT 2**: **WAVES & OSCILLATIONS AND ACOUSTICS**

***Waves & Oscillations****:* Categories of waves: Mechanical, electromagnetic, matter and gravitational – Reflection and transmission of waves at a boundary – Free oscillations – Damped Oscillations – Forced oscillations – Resonance – Coupled oscillations.

***Acoustics****:* Sound absorption – Absorption coefficient and its measurement – Reverberation time – Sabine‟s formula – Eyring‟s formula.

**UNIT 3**: **DIELECTRICS AND MAGNETIC MATERIALS**

***Dielectrics****:* Introduction – Dielectric Polarization – Types of Polarization – Lorentz field – Clausius- Mosotti equation – Dielectric strength, loss, breakdown.

***Magnetic materials****:* Introduction – Basic definitions – Origin of magnetic moment – Classification of magnetic materials into dia, para, ferro, antiferro and ferri magnetic materials – Hysteresis – Soft and hard magnetic materials – Applications of magnetic materials.

**UNIT 4**: **ADVANCED MATERIALS**

***Superconductors****:* Introduction – Properties of superconductors – Meissner effect– Type I and Type II superconductors – ac and dc Josephson effects – BCS theory (qualitative treatment) – High $T_c$ superconductors – Applications of superconductors.

***Nanomaterials***: Introduction – Significance of nanoscale – Surface area and quantum confinement – Physical properties: optical, thermal, mechanical and magnetic – Carbon nanotubes & their properties – Applications of nanomaterials.

***Smart Materials***: Shape Memory Alloys: Definition – Two phases – One way and two way memory effect – Pseudo elasticity – Applications

of shape memory alloys.

**UNIT 5: MATERIAL CHARACTERIZATION AND CRYSTALLOGRAPHY**

***Material Characterization:*** Electron microscopy: SEM, TEM, AFM – UV-Visible and IR Spectroscopy – Non-destructive testing: objectives – Methods: Pulse-echo method.

***Crystallography****:* Introduction – Space lattice –Unit cell – Lattice parameters –Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Miller indices – Interplanar spacing in cubic crystals – X-ray diffraction – Bragg‟s law – Laue method.

| | **COURSE OUTCOMES** |
|---|---|
| CO1 | The different realms of physics and their applications in both scientific and technological systems are achieved through the study of physical optics, lasers and fiber optics. |
| CO2 | The concepts of types of waves and oscillations ,acoustics are highlighted |
| CO3 | The dielectric and magnetic response of materials are focussed. |
| CO4 | The importance of superconducting materials, nano and smart materials along with their engineering applications are well elucidated. |
| CO5 | Characterization of materials by advanced techniques, the important properties of crystals like the presence of long-range order and periodicity, structure determination using X-ray diffraction technique are focused. |

**Prescribed Text books:**

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S.Chand and Company

**2.** Engineering physics – S. Mani Naidu, Pearson Education

3.Instrumental methods of analysis - Willard and Meritt

**Reference Books:**

1. Introduction to modern optics – Grant R Fowles
2. A text book on Optics – Brijlal & Subramanyam
3. Laser Fundamentals – William T. Silfvast, Cambridge University Press
4. Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons
5. Introduction to Nanotechnology – C P Poole and F J Owens, Wiley
6. Shape Memory Alloys-Modeling and Engg. Applications – C Lagoudas, Springer
7. Hand Book of Non-destructive evaluation, C.J.Hellier, McGraw-Hill
8. Engineering Physics – V. Rajendran, K.Thyagarajan Tata MacGraw Hill Publishers
9. Engineering Physics – M.R.Srinivasan, New Age Publications
10. Engineering Physics – D K Pandey, S. Chaturvedi, Cengage Learning
11. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press
12. Engineering Physics – M. Arumugam, Anuradha Publications

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 3 | 2 | | | | | | | | 2 | 1 | 1 |
| CO2 | 3 | | | | 2 | | | | 3 | | | | 2 | | |
| CO3 | 3 | | 3 | 3 | 2 | | | | | | | | 2 | 1 | 1 |
| CO4 | | 3 | 2 | | 3 | | | | | | | | 2 | 1 | 1 |
| CO5 | 3 | 3 | 3 | 2 | | | | | | | | | | | |

**JNTACEA** **R-15**

**2015-16**

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**DEPARTMENT OF MECHANICAL ENGINEERING**

| **I- Year B.Tech. M.E. II-Sem** | **T** | **P** | **C** |
|---|---|---|---|
| | **2** | **4** | **4** |

**ENGINEERING DRAWING-II (15A03201)**

**(MECHANICAL)**

| **Course Objectives:** To impart knowledge on | |
|---|---|
| C2 02.1 | To impart knowledge on Representing any matter/object with the help of picture. |
| C2 02.2 | To impart knowledge on Working drawings |
| C2 02.3 | To impart knowledge on Orthographic drawing of different machine parts. |
| C2 02.4 | To impart knowledge on Developing assembly drawings. |
| C2 02.5 | To impart knowledge on Developing assembly drawings |

**Unit –I**

Sections of solids: Sections and Sectional views of Regular solids –Prism, Cylinder, Pyramid, Cone – True shapes.

Development of Regular solids, sphere and transition piece.

**Unit –II**

Isometric projection: Isometric views of lines, plane figures, Compound solids, Spherical parts.

**Unit –III**

Conversion of Pictorial views to orthographic views –Conventions.

**Unit –IV**

Interpenetration of Solids – Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs cone, square prism Vs square prism.

**Unit –V**

Perspective projections –Planes and simple solids. Vanishing point Method only.

| | **Course Outcomes** |
|---|---|
| CO1 | The student will be able to draw the sectional views and the true shape of the sectional view of the regular solids like prism, cone, cylinder, pyramid and sphere and develop them. |
| CO2 | The student will be able to draw the 3D pictorial projections/views of the planes, regular solids and compound solids. |
| CO3 | Given with the 3D pictorial views, the student will be able to convert the figure to 2D orthographic view. |

| | |
|---|---|
| CO4 | Student will be able to draw the intersecting curves between the solids between the solids like cylinder, cone and prism. |
| CO5 | Student shall develop to draw the perspective projections of planes and regular solids with the help of the given data. |

**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.
2. Engineering Drawing, Shah and Rana,2/e, Pearson Education
3. Engineering Drawing and Graphics, Venugopal/New age Publishers
4. Engineering Graphics, John&john.

***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.*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 3 | 3 | | | | | | | 2 | | 2 |
| CO2 | 3 | | | | 3 | 3 | 3 | | | | | | 2 | 1 | |
| CO3 | 3 | | | | | 3 | | | 3 | | | | | 1 | 2 |
| CO4 | 3 | | | | 3 | | 3 | | 3 | | | | 2 | 1 | |
| CO5 | | | | | 3 | | 3 | | 3 | | | | | | 2 |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**DEPARTMENT OF MECHANICAL ENGINEERING**

| **I- Year B.Tech. M.E. II-Sem** | **L** | **P** | **C** |
|---|---|---|---|
| | **4** | **0** | **4** |

**ENGINEERING MECHANICS (15A01202)**

**(Common to Civil and Mechanical Engineering)**

| | **COURSE OBJECTIVES** |
|---|---|
| 1 | 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, Screw jack and differential 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 – Work Energy Method – Equation for Translation – Work Energy application to Particle Motion, Connection System – Fixed axis Rotation and Plane Motion.

**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

| | **COURSE OUTCOMES :** |
|---|---|
| CO1 | To acquire the basic knowledge of the analysis of general structures when external loads are applied. |
| CO2 | To understand the forces and their systems, equilibrium of systems of forces, static analysis of simple plane trusses. |
| CO3 | To know about friction and their types, area moment of inertia, mass moment of inertia |
| CO4 | Ability to know about kinematics, kinetics and concepts of mechanical vibrations. |
| CO5 | To understand the basic concepts in structural mechanics. |

**TEXT BOOKS**:

(1) Engineering Mechanics by Bhavakatti, New age Pubilishers
(2) Engineering Mechanics by Dr.R.k.Bansal, Lakshmi Publications.
(3) Engineering Mechanics – B. Bhattacharyya, Oxford University Publications.

**REFERENCES:**

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

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | | 3 | | 3 | | | | | 3 | 2 | | |
| CO2 | 3 | 3 | | 3 | | 3 | | | 3 | | 2 | | | 2 | 2 |
| CO3 | | | | 3 | 3 | 3 | 3 | | 3 | | | 3 | 2 | 2 | |
| CO4 | 3 | 3 | | 3 | | | | | | | 2 | | | | |
| CO5 | 3 | 3 | 3 | | 3 | | 3 | | 3 | | | 3 | 2 | | 2 |

**JNTACEA** **R-15**

**2015-16**

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**DEPARTMENT OF MECHANICAL ENGINEERING**

| **I- Year B.Tech. M.E. II-Sem** | **L** | **P** | **C** |
|---|---|---|---|
| | **0** | **4** | **2** |

**COMPUTER PROGRAMMING LAB**

**(15A05202)**

# (Common to All Branches)

| | **COURSE OBJECTIVES** |
|---|---|
| 1 | To work with the compound data types |
| 2 | To explore dynamic memory allocation concepts |
| 3 | Able to design the flowchart and algorithm for real world problems |
| 4 | Able to write C programs for real world problems using simple and compound data types |
| 5 | Employee good programming style, standards and practices during program development |

**Week-1**

1) Write a C program to make the following exchange between the variables a-> b -> c->d - > a
2) Write a C program to carry out the arithmetic operations addition, subtraction, multiplication, and division between two variables
3) Write a C program for printing prime numbers between 1 and n.

**Week-2**

1) Write a C program to construct a multiplication table for a given number.
2) Write a program to reverse the digit of a given integer.
3) Write a C program to find the sum of individual digits of a positive integer.
4) Write a C program to calculate the factorial of a given number

**Week-3**

1) Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

2) Write a program to calculate tax, given the following conditions:
   a) If income is less than 1,50,000 then no tax.
   b) If taxable income is in the range 1,50,001 – 300,000 then charge 10% tax
   c) If taxable income is in the range 3,00,001 – 500,000 then charge 20% tax
   d) If taxable income is above 5,00,001 then charge 30% tax

**Week-4**

1) Write a program to print the calendar for a month given the first Week- day of the month.

Input the first day of the month (Sun=0,Mon=1,Tue=2,Wed=3,.....) :: 3

Total number of days in the month : 31

Expected output

| *Sun* | *Mon* | *Tue* | *Wed* | *Thu* | *Fri* | *Sat* |
|---|---|---|---|---|---|---|
| - | - | - | *1* | *2* | *3* | *4* |
| *5* | *6* | *7* | *8* | *9* | *10* | *11* |
| *12* | *13* | *14* | *15* | *16* | *17* | *18* |
| *19* | *20* | *21* | *22* | *23* | *24* | *25* |

| | | | | | | |
|---|---|---|---|---|---|---|
| *25* | *26* | *27* | *28* | *29* | *30* | *31* |

2) Write a C program to find the roots of a quadratic equation

**Week-5**
1) Write a program to print the Pascal triangle for a given number
2) Write a C program to find the GCD (greatest common divisor) of two given integers
3) Write a C program to construct a pyramid of numbers.
4) Write C code to define a function cash_dispense, which takes an amount as its input, and returns the number of 1000, 500, 100, 50, 20, 10, 5, 2, 1 rupee denomination that make up the given amount

**Week-6**
1) Write C code to reverse the contents of the array. For example, [1,2,3,4,5] should become [5,4,3,2,1]
2) Write a C program that uses functions to perform the following:
   i) Addition of Two Matrices

   ii) Multiplication of Two Matrices

3) Write a program that will search and find out the position where the given key element exist in a user chosen array and print it as output.

**Week-7**
1) Write C code to compute the frequency table of survey responses given by 20 users. The survey responses range from 1 to 5 and are stored in an array. For example, 10 responses are stored in the array [1,1,5,2,3,3,5,5,2,2]. The frequency table will be as shown below:
   a. 1 = 2
   b. 2 = 3
   c. 3 = 2
   d. 4 = 0
   e. 5 = 3
2) Write a program to define a function to sort an array of integers in ascending order by using exchange sort.

**Week-8**
1) Write a C program to check whether a given string is a palindrome or not, without using any built-in functions.
2) Write a C program to determine if the given string is a palindrome or not by using string functions.
3) Write a function that accepts a string and delete the first character.
4) Write a function that accepts a string and delete all the leading spaces.

**Week-9** Write a program to accept a string from user and display number of vowels, consonants,

digits and special characters present in each of the words of the given string.

**Week-10**
1) Write a C program to define a union and structure both having exactly the same numbers using the sizeof operators print the sizeof structure variables as well as union variable
2) Declare a structure time that has three fields hr, min, secs. Create two variables,start_timeandend_time. Input there values from the user. Then while start_time is not equal to end_time display GOOD DAY on screen.

**Week-11**
1) Write a program to read in an array of names and to sort them in alphabetical order. Use sort function that receives pointers to the functions strcmp, and swap, sort in turn should call these functions via the pointers.
2) Write a program to read and display values of an integer array. Allocate space dynamically for the array using the *malloc()*.
3) Write a program to calculate area of a triangle using function that has the input parameters as pointers as sides of the triangle.

**Week-12**

1) Two text files are given with the names text1 and text2. These files have several lines of text. Write a program to merge (first line of text1 followed by first line of text2 and so on until both the files reach the end of the file) the lines of text1 and text2 and write the merged text to a new file text3.
2) Write a program to split a given text file into n parts. Name each part as the name of the original file followed by .part<**n**> where n is the sequence number of the part file.

| | **COURSE OUTCOMES** |
|---|---|
| CO1 | Translate algorithms in to programs |
| CO2 | Code and debug programs in C program language using various constructs. |
| CO3 | Formulate problems and implement algorithms in C. |
| CO4 | Able to use different data types in a computer program |

**Reference Books:**

1. Computer Science, A Structured Programming Approach Using C by Behrouz A. Forouzan& Richard F. Gilberg, Third Edition, Cengage Learning
2. C Programming A Problem-Solving Approach, Behrouz A. Forouzan& E.V. Prasad, F. Gilberg, Third Edition, Cengage Learning
3. Programming with C RemaTheraja, Oxford
4. "C Test Your Skills", Kamthane, Pearson Education
5. Programming in C: A Practical Approach, Ajay Mittal, Pearson
6. Problem solving with C, M.T.Somasekhara, PHI
7. C Programming with problem solving, J.A. Jones & K. Harrow,Dreamtech Press
8. Programming withc, Byron S Gottfried, Jitender Kumar Chhabra, TMH, 2011

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 2 | | 3 | 2 | | | 3 | 2 | | | | | |
| CO2 | | | 2 | | | | 1 | | | 2 | | 3 | | 3 | 1 |
| CO3 | 3 | | | 3 | | 2 | | 3 | | | | | | | |
| CO4 | | | | 3 | | 2 | | 3 | 3 | | 3 | | 1 | | |
| CO5 | | 3 | 2 | | 3 | | 1 | | | 2 | | | | | 1 |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**DEPARTMENT OF MECHANICAL ENGINEERING**

| I-B.Tech. II SEM | T | P | C |
|---|---|---|---|
| | 0 | 4 | 2 |

## ENGINEERING PHYSICS LABORATORY (15A52202)

| | **COURSE OBJECTIVES** |
|---|---|
| 1 | The Objective of this course is to make the students gain practical knowledge to correlate with the theoretical studies. |
| 2 | To develop practical applications of engineering materials and use of principle in the right way to implement the modern technology. |
| 3 | To train engineering students on basis of measurements and the instruments |
| 4 | To equip the students with practical knowledge in electronic, optics, and heat experiments |

**Any EIGHT of the following experiments has to be performed during the SEMESTER**

1. Determination of wavelengths of various colours of mercury spectrum using diffraction grating in normal incidence method
2. Determination of dispersive power of prism
3. Determination of thickness of thin object by wedge method
4. Determination of radius of curvature of lens by Newton‟s rings
5. Laser : Diffraction due to single slit
6. Laser : Diffraction due to double slit
7. Laser: Determination of wavelength using diffraction grating
8. Determination of Numerical aperture of an optical fiber
9. Meldes experiment: Determination of the frequency of tuning fork
10. Sonometer: Verification of the three laws of stretched strings
11. Energy gap of a material using p-n junction diode
12. Electrical conductivity by four probe method
13. Hall effect: Determination of mobility of charge carriers in semiconductor
14. B-H curve
15. Magnetic field along the axis of a current carrying coil – Stewart and Gee‟s method
16. Determination of dielectric constant and Curie temperature of a ferroelectric material

| | **COURSE OUTCOMES** |
|---|---|
| CO1 | On Completion of this course, students are able to –<br>Develop skills to impart practical knowledge in real time solution. |
| CO2 | Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations. |
| CO3 | Understand measurement technology, usage of new instruments and real time applications in engineering studies. |
| CO4 | The student will be able to analyze the physical principle involved in the various instruments, also relate the principle to new application. |
| CO5 | The various experiments in the areas of optics, mechanics and thermal physics will nurture the students in all branches of Engineering. |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | | 1 | | | | 3 | | | | 1 | | 2 | |
| CO2 | | 2 | | | 2 | | | | | | | 1 | 2 | | |
| CO3 | 1 | | 3 | 1 | | | 3 | | 2 | 3 | 1 | | 2 | | 3 |
| CO4 | | 2 | | | | 1 | | 3 | | | | | | | |
| CO5 | | | 3 | | | | | | 2 | | | | 2 | 2 | |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**Course Structure**

**DEPARTMENT OF MECHANICAL ENGINEERING**

# II Year B.Tech. ME- I Semester

| S.No | Subject Code | SUBJECT | T | P | CREDITS |
|---|---|---|---|---|---|
| 1 | 15A51301 | Mathematical Methods | 4 | 0 | 4 |
| 2 | 15A03301 | Thermodynamics | 4 | 0 | 4 |
| 3 | 15A03302 | Material Science and Metallurgy | 4 | 0 | 4 |
| 4 | 15A03303 | Kinematics of Machinery | 4 | 0 | 4 |
| 5 | 15A01307 | Mechanics of Solids | 4 | 0 | 4 |
| 6 | 15A24301 | Electrical and Electronics Engineering | 4 | 0 | 4 |
| 7 | 15A54302 | Human Values & Professional Ethics (Audit) | 2 | 0 | 0 |
| 8 | 15A24302 | Electrical and Electronics Engineering Lab | 0 | 4 | 2 |
| 9 | 15A13302 | Mechanics of Solids Lab & Material Science Lab | 0 | 4 | 2 |
| | | **Total** | **26** | **8** | **28** |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

**II Year B.Tech. M.E. I-Sem**

| T | P | C |
|---|---|---|
| 4 | 0 | 4 |

# MATHEMATICAL METHODS (15A51301)

# (CIVIL, MECH &CHEM)

| | **Course Objectives:** |
|---|---|
| 1 | 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.

| | **Course Outcomes:** |
|---|---|
| CO1 | The student will be able to analyze engineering problems using the concepts of Matrices and Numerical methods. |
| CO2 | They can able to find out the solutions for algebraic and transcendental equations. |
| CO3 | Able to do the problems on Newton's, Lagrange's, Gauss ,Stirling's & Bessel's formula. |
| CO4 | Students can able to solve the problems on curve fitting. |
| CO5 | They are able to find solutions for ordinary differential equations. |

**TEXT BOOKS:**

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

**REFERENCES:**

2. Engineering Mathematics, Volume - II, E. Rukmangadachari Pearson Publisher.
3. 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.

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | | 3 | | 2 | | | 2 | | | 1 | 3 | 2 | 3 |
| CO2 | | | 3 | | | | | | | | | | | | |
| CO3 | 3 | | | | | | | | 2 | | | | | | |
| CO4 | | 3 | | 3 | | | | | | | | | | 2 | |
| CO5 | | | 3 | | | 2 | | | | | | | 3 | | 3 |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

**II Year B.Tech. M.E. I-Sem**

| T | P | C |
|---|---|---|
| 4 | 0 | 4 |

# THERMODYNAMICS (15A03301)

| | Course Objectives |
|---|---|
| 1 | To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance. |

**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.

**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.

**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 AND AVAILABILITY:** 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, Gibbs & Helmholtz functions.

**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.

**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

*Note: Steam tables Mollier Diagrams Shall be supplied.*

| | **Course Outcomes** |
|---|---|
| CO1 | Describe basic concepts of thermodynamic property, cycle, constraints of equilibrium, reversibility and energy transfer in the form of Work and Heat with various applications. |
| CO2 | Analyse 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. |
| CO3 | Identify the major difference in working of a heat engine, refrigerator and heat pump. to calculate the maximum efficiency of a cycle |
| CO4 | Judge the properties of pure substances and method drawing phase equilibrium diagrams like P-v, h-s, T-s and P-T of a pure substance, usage of steam tables and mollier diagrams |
| CO5 | Understand and analyse of ideal gas& gas mixtures, Gas Power Cycles, concept of ideal cycles for different engines and their working principle. |

**TEXT BOOKS :**

1. Engineering Thermodynamics, P.K Nag, TMH Publishers, New Delhi.
2. Engineering Thermodynamics by P.L.Dhar, Elsevier – 2008.

**REFERENCES :**

1. Fundamentals of Thermodynamics – Sonntag, Borgnakke and van wylen, John Wiley & sons (ASIA) Pte Ltd.
2. Thermodynamics by Chattopadhyay, oxford
3. Thermodynamics – An Engineering Approach – YunusCengel& Boles, TMH
4. Thermodynamics – J.P.Holman, McGrawHill
5. An introduction to Thermodynamics, YVC Rao, New Age
6. Engineering Thermodynamics – Jones & Dugan

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 2 | | | | | 2 | | | 2 | | 2 | | 2 |
| CO2 | | 2 | 2 | 1 | | | | | | 2 | | 3 | | 2 | |
| CO3 | 3 | 2 | | | | | | 2 | | 2 | 2 | 3 | 2 | 2 | 2 |
| CO4 | | | | 1 | | | | 2 | | 2 | 2 | | 2 | 2 | |
| CO5 | | | 2 | 1 | | | | | | | | 3 | | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

**II Year B.Tech. M.E. I-Sem**

| T | P | C |
|---|---|---|
| 4 | 0 | 4 |

## MATERIAL SCIENCE AND METALLURGY (15A03302)

| | **COURSE OBJECTIVES**<br>Students can able to learn about |
|---|---|
| 1 | Structure of Metals and types of solids |
| 2 | They can understand the equilibrium diagrams, properties and structure of the mild steel an Iron. |
| 3 | Heat treatment of steel, properties and structure of ceramic ,composite materials |

**UNIT – I**

**Structure of Metals :** 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 Rotherys rules, intermediate alloy phases, and electron compounds.

**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, Bi-Cd, Cu-An, Cu-Sn 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.

**Non-ferrous Metals and Alloys :**

Structure and properties of copper and its alloys, Aluminium 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.

**UNIT – V**

**Ceramic materials:**
Crystalline ceramics, glasses, cermets, abrasive materials, nonmaterial's-definition, properties and application of the above.

**Composite Materials:** Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and Carbon – Carbon composites.

| | **COURSE OUTCOMES** |
|---|---|
| CO1 | Students can able to Study structure of different material. Select materials for design and construction. |
| CO2 | The importance of structure of materials. |
| CO3 | They can able the study the properties of ferrous and non ferrous materials. |
| CO4 | To study the heat alloys. |
| CO5 | To study about the ceramic and composite materials. |

**TEXT BOOKS :**

1. Introduction to Physical Metallurgy / Sidney H. Avener.
2. Essential of Materials science and engineering/ Donald R.Askeland/Thomson.

**REFERENCES :**

1. Material Science and Metallurgy/kodgire.
2. Science of Engineering Materials / Agarwal
3. Materials Science and engineering / William and collister.
4. Elements of Material science / V. Rahghavan
5. An introduction to materialscience / W.g.vinas & HL Mancini
6. Material science & material / C.D.Yesudian & harris Samuel
7. Engineering Materials and Their Applications – R. A Flinn and P K Trojan / Jaico Books.
8. Engineering materials and metallurgy/R. K. Rajput/ S.Chand

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 3 | | 2 | | 2 | | | | | | 2 | | 3 | |
| CO2 | 3 | | | 2 | | 2 | 1 | | | 2 | 2 | | | | 1 |
| CO3 | 3 | 3 | | | 2 | | 1 | | | | | | | | 1 |
| CO4 | | | 3 | | 2 | | 1 | | 3 | 2 | 2 | | | 3 | |
| CO5 | | 3 | 3 | | 2 | | 1 | | 3 | | | 2 | 3 | | |

.

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

**II Year B.Tech. M.E. I-Sem** **T P C**

**4 0 4**

# KINEMATICS OF MACHINERY (15A03303)

| | **COURSE OBJECTIVES** |
|---|---|
| 1 | Analysis of Mechanisms |
| 2 | Concept of straight line motion mechanisms and steering gear mechanisms |
| 3 | Principles involved in the displacement, velocity and acceleration at a point in a link of a mechanism |
| 4 | Concepts of toothed gearing and gear train. |
| 5 | Designing of cam profile and analysis of motion of followers. |

**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.

**UNIT-II**

**Straight Line Motion Mechanisms-** Exact and approximate, copied and generated types – Peaucellier, Hart and Scott Russel, Grasshopper, Watt, Tchebicheff and Robert Mechanisms. 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**

**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. Klein‟s 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.

**UNIT – IV**

**GEARS:** Higher pairs, 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, Simple problems.

**UNIT – V**

**CAMS:** Definitions of cam and follower – uses – Types of followers and cams – Terminology. Types of follower motion - Uniform velocity, Simple harmonic motion, Cycloidal and uniform acceleration–and retardation 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.

| | **Course outcomes** |
|---|---|
| CO1 | An understanding of concepts of different of mechanism with lower pairs and higher pairs. |
| CO2 | Gain the knowledge of different types of straight line mechanism and steering gear mechanisms. |
| CO3 | Obtain an in depth knowledge of finding displacement ,velocity and acceleration of different Points on different mechanisms using different methods (relative velocity, Instantaneous methods). |
| CO4 | Aquire the knowledge on different gear profiles and calculating the different parameters of gears.Gain the knowledge in designing of gear trains for the required purpose. |
| CO5 | Design and analyse different cam profile for different types of followers. |

**TEXT BOOKS :**

1. Theory of Machines, S.S. Rattan, Tata McGraw Hill Publishers.
2. The Theory of Machines, J.E. Shiegley, McGraw Hill .

**REFERENCES :**

1. Theory of Machines, R.K.Bansal and J S Brar, Laxmi Publications.
2. Theory of Machines, Thomas Bevan, CBS.
3. Mechanism and Machine Theory, J.S. Rao and R.V. Dukkipati, New Age
4. Theory of machines, P.L. Ballaney, Khanna Publishers.
5. Kinematics and dynamics of machinery, R.L Norton ,Tata McGraw Hill Publishers
6. Theory of Machines, by R.S. Khurmi & J.K. Gupta S. Chand Pub.

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | | 1 | | 1 | | 2 | | 1 | 2 | | |
| CO2 | 3 | 2 | 2 | | 2 | | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 3 | |
| CO3 | | | | 2 | 2 | 1 | 1 | | 1 | | 2 | 1 | | 3 | |
| CO4 | 3 | 2 | 2 | 2 | 2 | | 1 | | 1 | 2 | 2 | | 2 | 3 | |
| CO5 | | | 2 | | | | | 1 | | 2 | | | | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

**II Year B.Tech. M.E. I-Sem**

| T | P | C |
|---|---|---|
| 4 | 0 | 4 |

# MECHANICS OF SOLIDS (15A01307)

| | **Course Objectives:** |
|---|---|
| 1 | The subject provide the knowledge of simple stress strains flexural stresses in members, shear stresses and deflection in beams so that the concepts can be applied to the Engineering problems. |

**UNIT – I**

**SIMPLE STRESSES AND STRAINS : –** Deformable bodies **-** Elasticity and plasticity – Types of stresses and strains – Hooke‟s law – stress – strain diagram for mild steel – 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 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, uniformly distributed load 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.

**UNIT – III**

**FLEXURAL STRESSES :** Theory of simple bending – Assumptions – Derivation of bending equation: M/I =f/y = E/R – Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T,Angle and Channel sections – Design of simple beam sections.

**SHEAR STRESSES:** Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T and angle sections.

**UNIT – IV**

**TORSION OF CIRCULAR SHAFTS –** Theory of pure torsion – Derivation of Torsion equations : – Assumptions made in the theory 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-deflections of propped cantilevers for simple loading cases.

**UNIT – V**

**THIN CYLINDERS & THICK CYLINDERS :** Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – Changes in dia, and volume of thin cylinders – Thin spherical shells.

Introduction Lame‟s theory for thick cylinders – Derivation of lame‟s formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders – Necessary difference of radii for shrinkage – Thick spherical shells.

| | **Course Outcomes:** |
|---|---|
| CO1 | Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures. |
| CO2 | Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behavior for different types of loads. |
| CO3 | Determining the flexural stresses and shear stresses on different beams. |
| CO4 | Deriving torsion equation for circular shafts and and finding deflection on beams. |
| CO5 | Solving equations for stresses and strains , Applying Lame's theory for cylinders. |

**TEXT BOOKS :**

(1) Strength of Materials by B.S.Basavarajaiah, Universities Press, Hyderabad
(2) Strength of Materials by Dr.R.K.Bansal, Lakshmi Publications.
(3) Mechanics of Materials by Swaroop Adarash, New Age Publications

**REFERENCES:**

1. Mechanics of Materials – Dr.B.C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, Lakshmi Publications.
2. Strength of Materials by R.K Rajput, S.Chand & Company Ltd.
3. Strength of Materials by S.S.Bhavikatti, Vikas Publishing House Pvt. Ltd.
4. Strength of materials by Sadhu Singh, Khanna Pubilications, NewDelhi.
5. Strength of materials by Surendar Singh, CBS Pubilications.
6. Strength of Materials by L.S.Srinath et al., Macmillan India Ltd., Dew Delhi.

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | 3 | | | | 3 | 2 | | | 3 | | 3 |
| CO2 | | 3 | | | 3 | 2 | | | 3 | 2 | | 3 | 3 | 2 | 3 |
| CO3 | 3 | 3 | | | | | | | | 2 | | 3 | 3 | 2 | 3 |
| CO4 | 3 | | | | 3 | 2 | | | 3 | | | 3 | | 2 | |
| CO5 | | 3 | | | | 2 | | | | | | | | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

**II Year B.Tech. M.E. I-Sem** **T P C**

**4 0 4**

**ELECTRICAL ENGINEERING AND ELECTRONICS ENGINEERING (15A24301)**

**PART – A**

**ELECTRICAL ENGINEERING**

| | |
|---|---|
| | **Course Objectives:**To make the students learn about: |
| 1 | The basics of AC & DC Circuits, DC generators & motors. |
| 2 | The construction and operation of Transformers, Induction motors and their performance aspects will be studied. |

**UNIT – I**

**Introduction to DC & AC Circuits**

Ohm‟s Law, Basic Circuit Components, Kirchhoff‟s Laws, Types of Sources, Resistive Networks, Series Parallel Circuits, Star Delta and Delta Star Transformation. Principle of AC Voltages, Waveforms and Basic Definitions, Root Mean Square and Average Values of Alternating Currents and Voltage, Form Factor and Peak Factor, Phasor Representation of Alternating Quantities, The J Operator and Phasor
Algebra, Analysis of Ac Circuits With Single Basic Network Element, Single Phase Series.

**UNIT-II**

**DC Machines D.C Generators:**

Principle of Operation of Dc Machines, Types of D.C Generators, E.M.F Equation in D.C Generator, O.C.C. of a D.C. Shunt Generator D.C Motors: Principle of Operation of Dc Motors, Types of D.C Motors, Torque Equation, Losses and Efficiency Calculation in D.C Motor- Swinburne‟s Test

**UNIT-III**

**AC Machines Transformers:**

Principles of Operation, Constructional Details, Losses and Efficiency, Regulation of Transformer, Testing: OC & SC Tests. Three Phase Induction Motors: Principle of Operation, Slip and Rotor Frequency, Torque (Simple Problems).

**Alternators:** Principle of Operation-Constructional Details-EMF Equation-Voltage Regulation by Synchronous Impedance Method.

| | |
|---|---|
| **Course Outcomes**: After completing the course, the student should be able to : | |
| CO1 | Analyze the basics of AC & DC Circuits and know the performance characteristics of DC generators & motors. |
| CO2 | Study the D.C. Generators, D.C.Motors. |
| CO3 | Gets a thorough knowledge on Transformers, Induction motors & Alternators 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.
3. Electrical and Electronic Technology-By Hughes – Pearson Education.

**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

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | 2 | | | 2 | | 2 | | | | 1 | | 2 | 1 |
| CO2 | | | | 1 | | | 1 | | 3 | 2 | | | | | |
| CO3 | | 3 | | | 3 | | | 2 | | | 1 | 1 | 3 | | |
| CO4 | | | | 1 | | | 1 | | | | | | | 2 | |
| CO5 | 2 | | | | | | | 2 | 3 | | | | | | 1 |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

| **II Year B.Tech. M.E. I-Sem** | **T** | **P** | **C** |
|---|---|---|---|
| | **4** | **0** | **4** |

**ELECTRICAL ENGINEERING AND ELECTRONICS ENGINEERING (15A24301)**

**PART – B**

**ELECTRONICS ENGINEERING (15A24301)**

**(Common to Mech. Engg. & Chem. Engg.)**

| | **COURSE OBJECTIVES:** The students will be able to |
|---|---|
| 1 | Understand principle and terminology of electronics. |
| 2 | Analyze the characteristics of electronic devices and understand the working of basic circuits such as rectifiers, amplifiers, filters, oscillators. |
| 3 | Understand the concept of number systems. |
| 4 | Understand the concept & principles of logic devices. |

**PART-B**

**UNIT I**

Semiconductor Devices-N-Type and P-Type Semiconductors, The p-n Junction Diode - Drift and Diffusion Currents, Volt-Ampere Characteristics- Diode Specifications, Applications of Diode, Diode as a Switch. Diode as a Rectifier-types of Rectifier, Rectifiers with Filters, Zener Diode- Characteristics, Zener Diode as Voltage Regulator. Silicon Controlled Rectifier, DIAC, TRIAC.

**UNIT II**

Bipolar Junction Transistor (BJT) – Types of Transistors, Theory andOperations of Transistors, Input-Output Characteristics of BJT Configurations,Transistor Biasing- Fixed Bias, Voltage Divider Bias, Transistor Applications- Transistor as anAmplifier and Switch, Junction Field Effect Transistor (JFET)- (construction, principle of Operation, symbol), Characteristics -Input/output, Transfer Characteristics, Configurations of JFET, JFET Applications- JFET as an Amplifier and Switch, Comparison of BJT and JFET, MOSFET-The Enhancement and Depletion MOSFET, Characteristics and Applications of MOSFET

**UNIT III**

**Digital Electronics:** Number Systems-Decimal System, Binary System, Octal System,Hexadecimal System, Code Conversions, Binary Arithmetic- Binary Addition, Binary Subtraction, Logic Gates and Truth Tables-NOT, OR, AND, EX-OR, EX-NOR, Universal Gates-NAND, NOR Gates. Boolean algebra and De Morgan‟s Theorems,

| | **COURSE OUTCOMES**<br>At the end of this course the student will be able to |
|---|---|
| CO1 | Apply the concept of science and mathematics to explain the working of diodes and its applications, working of transistor and its characteristics and to analyze and design different transistor biasing circuits. |
| CO2 | Analyze the applications of operational amplifiers. |
| CO3 | Solve problems of various digital logic gates and circuits. |
| CO4 | Correlate the fundamental concepts to various Real life applications of today. |

.

**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.
3. Electrical and Electronic Technology-By Hughes – Pearson Education.
4. Basic Electrical and Electronics Engineering, M.S.Sukhija, T.K.Nagsarkar, Oxford University Press, 1st Edition, 2012.
5. Basic Electrical and Electronics Engineering, S.K Bhattacharya, Pearson Education, 2012.

**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

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | 1 | | | 1 | | 2 | | | | 2 | | | |
| CO2 | | 2 | | 3 | 2 | | | | | 1 | 3 | | | 2 | 1 |
| CO3 | | | 1 | | 2 | | 3 | | 1 | | | 1 | | | |
| CO4 | | | | | 2 | | | | | | 3 | | | | 1 |
| CO5 | | | | | | 1 | | | | 1 | | 1 | 3 | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

**II Year B.Tech. M.E. I-Sem**

| T | P | C |
|---|---|---|
| 2 | 0 | 0 |

## HUMAN VALUES AND PROFESSIONAL ETHICS (15A54302)

| | **Course Objectives:** |
|---|---|
| 1 | To create an awareness on Engineering Ethics and Human Values. |
| 2 | To instill Moral and Social Values and Loyalty |
| 3 | To appreciate the rights of Others |

### Unit I: HUMAN VALUES

Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty - Courage- Co Operation – Commitment – Empathy –Self Confidence Character – Spirituality.

### Unit II: ENGINEERING ETHICS

Senses of „Engineering Ethics- Variety of moral issued – Types of inquiry – Moral dilemmas – Moral autonomy –Kohlberg‟s theory- Gilligan‟s theory- Consensus and controversy –Models of professional roles- Theories about right action- Self interest - Customs and religion –Uses of Ethical theories – Valuing time –Co operation – Commitment.

### Unit III :ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering As Social Experimentation – Framing the problem – Determining the facts – Codes of Ethics – Clarifying Concepts – Application issues – Common Ground - General Principles – Utilitarian thinking respect for persons.

### UNIT IV: ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK

Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing risk- Safety and the Engineer- Designing for the safety- Intellectual Property rights(IPR).

### UINIT V: GLOBAL ISSUES

Globalization – Cross culture issues- Environmental Ethics – Computer Ethics – Computers as the instrument of Unethical behavior – Computers as the object of Unethical acts – Autonomous Computers- Computer codes of Ethics – Weapons Development - Ethics and

| | **Course Outcomes:** |
|---|---|
| CO1 | Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field. |
| CO2 | Identify the multiple ethical interests at stake in a real-world situation or practice |
| CO3 | Articulate what makes a particular course of action ethically defensible and their own ethical values and the social context of problems. |
| CO4 | Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work. |
| CO5 | Integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research. |

Text Books

1. "Engineering Ethics" by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.
2. "Ethics in Engineering" by Mike W. Martin and Roland Schinzinger – Tata McGraw-Hill– 2003.
3. "Professional Ethics and Morals" by Prof.A.R.Aryasri, Dharanikota Suyodhana-Maruthi Publications.
4. "Professional Ethics and Human Values" by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran- Laxmi Publications.
5. . "Indian Culture, Values and Professional Ethics" by PSR Murthy-BS Publication. Research – Analyzing Ethical Problems in research – Intellectual property Rights( IPR).
6. "Professional Ethics and Human Values" by Prof.D.R.Kiran-

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 1 | | 3 | 1 | 1 | | | | | |
| CO2 | | | | | | 1 | | 3 | 1 | 1 | | | | | |
| CO3 | | | | | | 1 | | 3 | 1 | 1 | | | | | |
| CO4 | | | | | | 1 | | 3 | 1 | 1 | | | | | |
| CO5 | | | | | | 1 | | 3 | 1 | 1 | | | | | |

**JNTUACEA** **R-15**

**2015-16**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

**II Year B.Tech. M.E. I-Sem** **T P C**

**0 4 2**

## ELECTRICAL ENGINEERING AND ELECTRONICS ENGINEERING LAB (15A24302)

## PART – A: ELECTRICAL ENGINEERING LAB

| | **Course Objectives** |
|---|---|
| 1 | The DC motors, DC Generators and know various characteristics, performance analysis of DC machines and speed control techniques of DC machines. |
| 2 | Various test conditions of single phase transformers. |

The following experiments are required to be conducted as compulsory experiments:

1. Swinburne‟s Test on DC Shunt Machine (Predetermination of Efficiency of a Given DC Shunt Machine Working as Motor and Generator).
2. OC & SC Tests on Single-Phase Transformer (Predetermination of Efficiency and Regulation at Given Power Factors and Determination of Equivalent Circuit).
3. Brake Test on 3-Phase Induction Motor (Determination of Performance Characteristics).
4. Regulation of Alternator by Synchronous Impedance Methods.
5. Speed Control of D.C.Shunt Motor by
   a). Armature Voltage Control b) Field Flux Control Method
6. Brake Test on D.C Shunt Motor

| **Course Outcomes**: After completing the course, the student should be able to do the following | |
|---|---|
| CO1 | Learn about DC motors, DC Generators and know various characteristics, performance analysis of DC machines and speed control techniques of DC machines. |
| CO2 | Various test conditions of single phase transformers. |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | 3 | | 1 | | 3 | | | | | 1 | | |
| CO2 | | | 1 | | | | | | 1 | | 1 | | | | 2 |
| CO3 | | | 1 | 3 | | | 2 | | 1 | | | 1 | 1 | 3 | |
| CO4 | | 2 | | | 2 | | | 3 | | 2 | 1 | | | | |
| CO5 | | | | | | | | | | | | | | 3 | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**
**MECHANICAL ENGINEERING DEPARTMENT**

**II Year B.Tech. M.E. I-Sem** **T P C**

**0 4 2**

## ELECTRICAL ENGINEERING AND ELECTRONICS ENGINEERING LAB (15A24302)

## ELECTRONICS ENGINEERING LAB
**(Six Experiments)**

| | **COURSE OBJECTIVES**<br>The students will be able to |
|---|---|
| 1 | Understand the characteristics of PN junction diode and zener diode. |
| 2 | Understand the characteristics of BJT in CE and CB configurations |
| 3 | Learn the frequency response of CE Amplifier |
| 4 | Exposed to linear and digital integrated circuits |

1. P-N Junction Diode and Zener Diode Volt-Ampere Characteristics.

2. Half-Wave Rectifier- a) Without Filter b) With Capacitor Filter.

3. Full-Wave Rectifier- a) Without Filter b) With Capacitor Filter.

4. Bipolar Junction Transistor in CE Configuration-Input and Output Characteristics, Computation of β.

5. Junction field effect Transistor in Common Source Configuration Output and Transfer Characteristics.

6. Verification of Logic Gates- AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR

| | **COURSE OUTCOMES** |
|---|---|
| CO1 | Learn the characteristics of basic electronic devices like PN junction diode, Zener diode & BJT. |
| CO2 | Analyze the application of diode as rectifiers, clippers and clampers. |
| CO3 | Learn the fundamental principles of amplifier circuits and need of Bias in Amplifier circuits. |
| CO4 | Learn the basics of linear integrated circuits and understand characteristics of operational amplifier. |
| CO5 | Learn about available digital ICs and verify truth tables of logic gates and flip flops. |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 2 | | | | 1 | | | | 1 | | |
| CO2 | 3 | 1 | 1 | | | | 1 | | 1 | | | | 1 | | |
| CO3 | | | | 3 | | 1 | | 3 | | 2 | 2 | | | 1 | 2 |
| CO4 | | 1 | | | | 1 | | | | | | 3 | | | |
| CO5 | | | | | 2 | | | 3 | | 2 | | | | | |

**JNTUACEA** **R-15**

**2015-16**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

**II Year B.Tech. M.E. I-Sem**

| T | P | C |
|---|---|---|
| 0 | 4 | 2 |

## MECHANICS OF SOLIDS LAB (15A13302) (A)

| | Course Objectives: |
|---|---|
| 1 | The object of the course to make the student to understand the behaviour of materials under different types of loading for different types structures. |

**LIST OF EXERCISES :**

2. Tension test.
3. Bending test on (Steel/Wood) Cantilever beam.
4. Bending test on simple support beam.
5. Torsion test.
6. Hardness test.
7. Shear test

| | Course Outcomes: |
|---|---|
| CO1 | Ability to perform different destructive testing. |
| CO2 | Ability to characteristic materials. |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 2 | 1 | 2 | 1 | 1 | | 1 | | 1 | | 1 | | 1 |
| CO2 | 1 | 2 | 2 | 1 | 2 | 1 | | 1 | | 1 | | 1 | | 1 | |
| CO3 | | | | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | | | | |
| CO5 | | | | | | | | | | | | | | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

**II Year B.Tech. M.E. I-Sem** **T P C**

**0 4 2**

# MATERIAL SCIENCE LAB (15A13302) (B)

| | **Course Objectives:** |
|---|---|
| 1 | To impart knowledge on metallographic techniques for studying the microstructures of alloys. |

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.

2.Preparation and study of the Microstructure of Mild steels, low carbon steels,

high – C steels.

3. Study of the Micro Structures of Cast Irons.

4. Study of the Micro Structures of Non-Ferrous alloys.

5. Study of the Micro structures of Heat treated steels.

6. Hardeneability of steels by Jominy End Quench Test.

7. To find out the hardness of various treated and untreated steels.

| **Course Outcomes:** | |
|---|---|
| Co1 | Ability to relate properties of microstructure. |
| Co2 | Understand various crystal structures. |
| Co3 | To study the thermosetting of ferrous and non ferrous materials. |
| Co4 | To test magnetic defects of material. |
| Co5 | To test the strength of material. |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | | 2 | 2 | | | 3 | | | 3 | | | 1 |
| CO2 | | 3 | | 2 | | | 3 | | | 2 | 3 | | | 3 | |
| CO3 | 3 | | 3 | | 2 | | | | 3 | | 3 | 3 | | | |
| CO4 | | 3 | | | | 2 | 3 | | | 2 | | | | | |
| CO5 | | | | 2 | | | | | | | | | | | |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**Course Structure**

**DEPARTMENT OF MECHANICAL ENGINEERING**

# II Year B.Tech. ME- II Semester

| S.No | Subject Code | SUBJECT | T | P | CREDITS |
|---|---|---|---|---|---|
| 1 | 15A51401 | Probability and Statistics | 4 | 0 | 4 |
| 2 | 15A54401 | Managerial Economics and Financial Analysis | 4 | 0 | 4 |
| 3 | 15A01407 | Fluis Mechanics and Hydraulic machinery | 4 | 0 | 4 |
| 4 | 15A03401 | Manufacturing Technology | 4 | 0 | 4 |
| 5 | 15A03402 | Thermal Engineering-I | 4 | 0 | 4 |
| 6 | 15A03403 | Machine Drawing | 2 | 4 | 4 |
| 7 | 15A03404 | Manufacturing Technology Lab | 0 | 4 | 2 |
| 8 | 15A01408 | Fluid Mechanics & Hydraulic Machinery Lab | 0 | 4 | 2 |
| | | **Total** | **22** | **12** | **28** |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

**II Year B.Tech. M.E. II-Sem**

| T | P | C |
|---|---|---|
| 4 | 0 | 4 |

# PROBABILITY AND STATISTICS (15A51401)

## (Common for CIVIL, MECH & CHEM)

| | |
|---|---|
| | **Course Objectives:** To impart knowledge on |
| 1 | To help the students in getting a thorough understanding of the fundamentals of probability and usage of statistical techniques like testing of hypothesis, Statistical Quality Control and Queuing theory. |

**UNIT – I**

Basic concepts of Probability – Random variables – Expectation – Discrete and continuous Distributions – Distribution functions. Binomial and poison distributions Normal distribution – Related properties.

**UNIT – II**

Test of Hypothesis: Population and Sample - Confidence interval of mean from Normal distribution - Statistical hypothesis - Null and Alternative hypothesis - Level of significance. Test of significance - Test based on normal distribution - Z test for means and proportions.

**UNIT – III**

Small samples - t- test for one sample and two sample problem and paired t-test, F-test and Chi-square test (testing of goodness of fit and independence).

**UNIT – IV**

Statistical Quality Control: Concept of quality of a manufactured product -Defects and Defectives - Causes of variations - Random and assignable - The principle of Shewhart Control Chart-Charts for attribute and variable quality characteristics- Constructions and Operati
on of □ - Chart, R-Chart, p - Chart and C-Chart.

**UNIT – V**

Queuing Theory: Pure Birth and Death process, M/M/1 & M/M/S & their related simple problems.

| | **Course outcomes:** |
|---|---|
| C01 | Understanding the fundamentals of probability and Distributions. |
| C02 | Usage of statistical techniques like testing of hypothesis |
| C03 | They can able to understand the different sample testslike t-test, F-test and Chi-square test. |
| C04 | Analysis of Statistical Quality Control charts |
| C05 | They can able to analyse the Queuing theory problems and draw appropriate inferences. |

**TEXT BOOKS:**

1. Probability & Statistics by E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher.
2. Probability & Statistics for engineers by Dr. J. Ravichandran WILEY-INDIA publishers.

**REFERENCES:**

1. Probability & Statistics by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad, S.Chand publications.
2. Statistical methods by S.P. Gupta, S.Chand publications.
3. Probability & Statistics for Science and Engineering by G.Shanker Rao, Universities Press.
4. Probability and Statistics for Engineering and Sciences by Jay L.Devore, CENGAGE.
5. Probability and Statistics by R.A. Jhonson and Gupta C.B.

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 1 | 2 | 1 | 2 | 3 | | | 1 | 2 | 2 | 2 | | 2 |
| CO2 | 2 | 3 | | 2 | | 2 | | | | 1 | 2 | 2 | 2 | | 2 |
| CO3 | 2 | 3 | 1 | 2 | 1 | | | | | | | 2 | 2 | 1 | |
| CO4 | 2 | 3 | 1 | 2 | 1 | | | | | | 2 | 2 | 2 | 1 | 2 |
| CO5 | 2 | 3 | 1 | 2 | | | | | | 1 | | | 2 | 1 | 2 |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):ANANTAPURAMU**

| **II Year B.Tech. M.E. II-Sem** | **T** | **P** | **C** |
|---|---|---|---|
| | **4** | **0** | **4** |

**MANAGERIAL ECONOMICS & FINANCIAL ANALYSIS (15A54401)**

| | **Course Objectives:** To impart knowledge on |
|---|---|
| 1 | 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. |

**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 - 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 -Relationship of Managerial Economics with Financial Accounting and Management.

**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: 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)

**UNIT V: 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).

***The students are required to submit any one of the following- two assignments/ a mini project/submission of any two case studies in the subject.***

| | **Course Outcomes**: |
|---|---|
| CO 1 | After completion of this course, the student will able to understand various aspects of Managerial Economics. |
| CO 2 | Study the functions of productions and cost analysis. |
| CO 3 | Analysis of financial statements and inputs therein will help them to make sound and effective decisions under different economic environment and market situations. |
| CO 4 | Understanding the concept of capital and methods and evaluation of capital budgeting. |
| CO 5 | They can able to study the concept of financial accounting and its analysis |

**TEXT BOOKS:**

1. Varshney & Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Ahuja H.L Managerial economics. S.Chand, 3/e, 2013
3.

**REFERENCES**

1. Aryasri: Managerial Economics and Financial Analysis, 4/e, TMH, 2013

2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International,. 2013.

3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.

4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | 2 | 1 | 1 | | | | 2 | | 1 | 2 | | 1 |
| CO2 | 3 | 2 | 2 | | 1 | | | | | | | 1 | | | 1 |
| CO3 | | 2 | | 2 | 1 | | | | | | 2 | | 2 | 1 | 1 |
| CO4 | 3 | 2 | 2 | | | | | | | | 2 | 1 | | 1 | 1 |
| CO5 | | 2 | | 2 | | | | | | 2 | 2 | 1 | 2 | 1 | 1 |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

**II Year B.Tech. M.E. II-Sem**

| T | P | C |
|---|---|---|
| 4 | 0 | 4 |

## FLUID MECHANICS AND HYDRAULIC MACHINERY (15A01407)

| | Course Objectives: |
|---|---|
| 1 | The applications of the conservation laws to flow through pipes and hydraulic machines are studied. |
| 2 | To understand the importance of dimensional analysis. |
| 3 | To understand the importance of various types of flow in pumps and turbines. |

**UNIT - I**

**FLUID STATICS** : Dimensions and units: physical properties of fluids – specific gravity, porosity surface tension – vapor pressure and their influence on fluid motion – atmospheric gauge and vacuum pressure – measurement of pressure – Piezometer, U-tube differential manometers.

**FLUID KINEMATICS** : stream line, path line and streak lines and steam tube, classification of flows-steady & unsteady, uniform, non uniform, laminar, turbulent, rotational, and irrotational flows-equation of continuity for one dimensional flow.

**Fluid dynamics:** surface and body forces – Euler‟s and Bernoulli‟s equations for flowing stream line, momentum equation and its application on force on pipe bend.

**UNIT – II**

**CONDUIT FLOW: Reynold‟s** experiment – Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel – total energy line-hydraulic gradient line. Measurement of flow: pilot tube, venturimeter, and orifice meter, Flow nozzle, Turbine current meter.

**UNIT – III**

**TURBO MACHINERY** : hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jEt striking centrally and at tip, velocity diagrams, work done efficiency, flow over radial vanes.

**HYDROELECTRIC POWER STATIONS**: Elements of hydro electric power station-types-concept of pumped storage plants-storage requirements.

**UNIT – IV**

**HYDRAULIC TURBINES**: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies hydraulic design-draft tube- theory- functions and efficiency.

**PERFORMANCE OF HYDRAULIC TURBINES** : Unit and specific quantities, characteristic c governing of turbines, selection of type of turbine, cavitation, surge tank, hammer.

**UNIT – V**

**CENTRIFUGAL PUMPS** : Classification, working, work done – manomertic head – loss efficiencies – specific speed – pumps in series and parallel – performance characteristic curves, NPSH.

**Course Outcomes:**

| | |
|---|---|
| C01 | Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid. |
| C02 | Studying the losses and measurement of flow in pipes. |
| C03 | Deriving equations when jet strikes on various and positions on vanes |
| C04 | Can critically analyse the performance of pumps . |
| C05 | Analyse the performance of turbines. |

**TEXT BOOKS :**

1. Hydraulics, fluid mechanics and Hydraulic machinery MODI and SETH. Standard book house
2. Fluid Mechanics by Dr.R.K.Bansal, Lakshmi Publications Pvt.Ltd.
3. Fluid Mechanics and Machinery by D.Rama Durgaiah, New Age International.

**REFERENCE BOOKS :**

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria &Sons
2. Hydraulic Machines by Banga & Sharma, Khanna Publishers.
3. Instrumentation for Engineering Measurements by James W.Dally, Wiley Riley, John Wiley & Sons Inc. 2004.

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | | 1 | 2 | | | | | | 2 | 3 | | 2 |
| CO2 | | | | 1 | | | | | | | | 2 | | 1 | |
| CO3 | 3 | | | | | 2 | | | | | | | 3 | | 2 |
| CO4 | | 3 | | 1 | 1 | | | | | | | 2 | | 1 | |
| CO5 | | | 3 | | | | | | | | | | | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

**II Year B.Tech. M.E. II-Sem**

| T | P | C |
|---|---|---|
| 4 | 0 | 4 |

# MANUFATURING TECHNOLOGY (15A03401)

| | **Course Objectives:** To impart knowledge on |
|---|---|
| 1 | Principle, procedure and applications of casting and welding processes. |
| 2 | Principle, procedure and applications of powder metallurgy process. |

**UNIT – I**

**Methods of Melting:** Crucible melting and cupola operation, steel making processes.

**CASTING:** Steps involved in making a casting– Types of patterns - Patterns and Pattern making — Materials used for patterns, pattern allowances and their Construction, Moulding Materials, Cores.

**UNIT – II**

Principles of Gating, Gating ratio and design of Gating systems, Solidification of casting – Concept – Solidification of pure metal and alloys, short & long freezing range alloys. Risers – Types function and design, casting design considerations, Causes and Remedies of Casting Defects. Casting processes 1) Centrifugal 2) Die 3) Investment.

**UNIT – III**

**Welding:** Classification of welding process types of welds and electrodes, welded joints and their characteristics, design of welded joints, Gas welding-types of flames, welding process, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding. Oxy – Acetylene Gas cutting, Plasma Cutting, Inert Gas welding.

**UNIT- IV**

TIG & MIG, welding, Friction welding, Induction welding, Explosive welding, Laser welding, Electronic beam welding, Ultrasonic welding, Soldering & Brazing. Heat affected zones in welding; welding defects – causes and remedies – destructive non-destructive testing of welds.

**UNIT - V**

Plastic –types, properties and their applications; processing of plastic – different methods – blow and injection molding, process capabilities and equipment details. Ceramic – Processing of different types of ceramics- compaction of metal powders, sintering, finishing operations, process capabilities.

| | **Course Outcomes:**<br>Ability to |
|---|---|
| CO1 | Learn the basic operation of various methods of melting and casting. |
| CO2 | Learn how various principles of gating and different casting processes and its remedies. |
| CO3 | Study the classification of welding processes and types of welds. |
| CO4 | Learn the types of welds and its defects , remedies destructive non-destructive testing of welds. |
| CO5 | Study the types, properties and processes of plastic. |

**TEXT BOOKS:**

1. Manufacturing Technology / P.N. Rao/TMH
2. Manufacturing Technology/ kalpak Jian, Pearson education

**REFERENCES:**

1. Production Technology / R.K. Jain
2. Process and materials of manufacturing –Lindberg/PE
3. Principles of Metal Castings / Rosenthal.
4. Welding Process / Paramar
5. Manufacturing Technology / R.K. Rajput, Laxhimi Pub
6. Workshop Technology Vol-, by Raghuvamsi

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | 3 | | 2 | | | 2 | 3 | | 3 | | 3 | | 3 |
| CO2 | 3 | 3 | | 3 | | | | | | 3 | | 3 | | 3 | |
| CO3 | | | 3 | | 3 | | | 2 | 3 | 2 | 3 | | 3 | | 3 |
| CO4 | | 3 | | 3 | | | | | | 1 | | 3 | | 3 | |
| CO5 | 3 | | 3 | | 1 | | | 2 | 3 | | 3 | | 3 | | 3 |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):ANANTAPURAUM**

| **II Year B.Tech. M.E. II-Sem** | **T** | **P** | **C** |
|---|---|---|---|
| | **4** | **0** | **4** |

**THERMAL ENGINEERING – I (15A03402)**

| | **Course Objectives:** To impart knowledge on |
|---|---|
| 1 | Testing and performance of IC Engines |
| 2 | Air compressors, fuel systems. |

**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.

**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.

**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.

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

**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.

**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.

- **Students are advised to refer the text book of "Internal Combustion Engine Fundamentals" by John B. Heywood.**

| | **Course Outcomes:** On successful completion of the course, the student will be able to, |
|---|---|
| CO1 | To be able to understand working of different I.C Engines and recognize basic elements and subsystems of an I.C. Engine |
| CO2 | To be able to know about S.I Engine fuel air requirements and understand fuel supply systems in an S.I Engine. |
| CO3 | Ability to understand necessity and functioning of cooling, lubrication and ignition system of an I.C. Engine. |
| CO4 | To be able to understand in-cylinder combustion in S.I and C.I Engines and know about the parameters that influence normal and abnormal combustions. |
| CO5 | To be able to know about working principle of various types of air compressors and solve problems related to reciprocating air compressor |

**TEXT BOOKS:**

1. I.C. Engines / V. Ganesan- TMH
2. Thermal Engineering / Rajput / Lakshmi Publications.

**REFERENCES:**

1. IC Engines – Mathur& Sharma – DhanpathRai& Sons.
2. Internal Combustion Engines by K.K. Ramalingam, Scitech Publications.
3. Engineering fundamentals of IC Engines – Pulkrabek, Pearson, PHI
4. Thermal Engineering, Rudramoorthy - TMH
5. Thermodynamics & Heat Engines, B. Yadav, Central Book Depot., Allahabad
6. I.C. Engines, Heywood, McGrawHIll.
7. Thermal Engineering – R.S. Khurmi & J.K.Gupta – S.Chand
8. Thermal engineering data book-B.Srinivasulu Reddy, JK International Pub.

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 1 | | | | | | 2 | | | 3 | | | 3 | |
| CO2 | | | | | 3 | | | | 1 | | | 3 | | | |
| CO3 | 1 | | | | | | | | | 2 | | | 2 | | 2 |
| CO4 | | 1 | | | | | 1 | | 1 | | | | | | |
| CO5 | 1 | | | | | | | 2 | | | 3 | | 2 | 3 | 2 |
| CO6 | | 1 | | | 3 | | | | 1 | 2 | | | 2 | | |

**JNTUACEA** **R-15**

**2015-16**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

**II Year B.Tech. M.E. II-Sem**

| T | P | C |
|---|---|---|
| 2 | 4 | 4 |

# MACHINE DRAWING (15A03403)

| **Course Objectives:**To impart knowledge on | |
|---|---|
| C2 02.1 | Understand the design process, properties of materials and machining considerations in design and able calibrate the stresses in machine members. |
| C2 02.2 | They are able to know the component behavior subjected to fluctuating loads. |
| C2 02.3 | Analyze the Design of riveted joints and Bolted joints |
| C2 02.4 | They can understand the design of cotters knuckle joints and also the design of solid and hollow shafts. |
| C2 02.5 | Students are able to know the Design of keys, couplings. |

**UNIT- I**

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

a) Conventional representation of material, common machine elements and parts such as screws, nuts, bolts, keys, gears, webs, ribs. Parts not usually sectioned.
b) Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and tapered features.
c) Title boxes, their size, location and details-common abbreviations & their liberal usage

**UNIT-II**

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

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

**UNIT- III**

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

a) Engine parts- stuffing boxes, cross heads, Eccentrics, Petrol Engine-connecting rod, piston assembly.
b) Other machine parts- Screw jack, Machine Vice, single tool post.
c) Valves: Steam stop valve, feed check valve. Non return value.

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

| | **Course Outcomes:** Ability to |
|---|---|
| C01 | Understand drafting fundamentals and standards. |
| C02 | Interpret drawings and extract required information |
| CO3 | Create part drawings and sectional views of machine components. |
| CO4 | Develop assembly drawings from part drawings. |
| CO5 | Carry out tolerance analysis and specify appropriate tolerances for machine design applications |

**Text Books**:

1. Machine Drawing- K.L. Narayana, P.Kannaiah&K.Venkata Reddy, New Age Publishers
2. Machine Drawing- Dhawan, S.Chand Publications

**References**:

1. Machine Drawing- P.S. Gill.
2. Machine Drawing- Luzzader
3. Machine Drawing – Rajput
4. Textbook of Machine Drawing-K.C.John,2009, PHI learning

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 3 | | | | | | | | | 3 | | | | 1 |
| CO2 | 2 | | | | | | | | | 3 | | | 3 | | |
| CO3 | 2 | | | | 3 | | | 2 | | | | 3 | | | 1 |
| CO4 | | | | | | | | | | 3 | | 3 | | 3 | |
| CO5 | | | | | | | | | | | 3 | | | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

**II Year B.Tech. M.E. II-Sem**

| T | P | C |
|---|---|---|
| 0 | 3 | 2 |

# MANUFACTURING TECHNOLOGY LAB (15A03404)

| **Course Objectives:** To make the student to know | |
|---|---|
| 1 | Design and manufacture of simple patterns. |
| 2 | Arc welding, gas welding and resistance welding equipment for the fabrication of welded joints. |
| 3 | Pipe bending and injection moulding equipment |

Minimum of 12 Exercises need to be performed

**I. METAL CASTING LAB:**

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

**II. WELDING LAB :**

1. ARC Welding Lap & Butt Joint - 2 Exercises
2. Spot Welding - 1 Exercise
3. TIG Welding - 1 Exercise
4. Plasma welding and Brazing - 2 Exercises (Water Plasma Device)

**III. MECHANICAL PRESS WORKING:**

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

**IV. PROCESSING OF PLASTICS**

1. Injection Moulding
2. Blow Moulding

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

| | **Course Outcomes:** Ability to |
|---|---|
| C01 | Design and manufacturing of simple pattern |
| C02 | Control sand properties in foundry |
| C03 | Operate arc welding, spot welding equipment. |
| CO4 | Create a cavity in sand using mould |
| C05 | Study about the injection moulding |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | | 2 | | 2 | | | | | | | | 2 |
| CO2 | 2 | | | 3 | | | | | | 2 | | | 3 | 1 | |
| CO3 | | | | | | 3 | | | 2 | | | | | | 2 |
| CO4 | | 2 | | | | | 2 | | | | | 2 | | 1 | |
| CO5 | 2 | | | | 2 | | | | | | | | | | |

**JNTUACEA** **R-15**

**2015-16**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

**II Year B.Tech. M.E. II-Sem** **T P C**

**0 3 2**

## FLUID MECHANICS AND HYDRAULIC MACHINERY LAB (15A01408)

| | **Course Objectives:** |
|---|---|
| 1 | The object of the course to make the students understand the fluid flow concepts and get familiarity with flow measuring devices. |

**LIST OF EXERCISES:**

1. Calibration of Venturimeter
2. Calibration of Orifice meter
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable head method.
5. Calibration of contracted Rectangular Notch and /or Triangular Notch.
6. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
7. Verification of Bernoulli‟s equation.
8. Impact of jet on vanes.
9. Study of Hydraulic jump.
10. Performance test on Pelton wheel turbine.
11. Performance test on Francis turbine.
12. Efficiency test on centrifugal pump.

| | **Course Outcomes:** |
|---|---|
| CO1 | Ability to use the measurement equipments for flow measurement. |
| CO2 | Ability to Determine Coefficient of discharge for a small orifice and an external mouth piece and loss of head. |
| CO3 | Calibration on rectangular and triangular Notch. |
| CO4 | Verifying the Bernoulli’s equation, determine the impact of jet on vanes. |
| CO5 | Performance test on turbines and pumps. |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | | 1 | 2 | | | | 1 | | 2 | 3 | | 2 |
| CO2 | | | | 1 | 1 | | | | | | | | | 1 | 2 |
| CO3 | 3 | | | | | 2 | | | | | | | | | |
| CO4 | | 3 | | 1 | 1 | | | | | | | | | | |
| CO5 | | | 3 | | | 2 | | | | 1 | | 2 | | | |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**Course Structure**

**DEPARTMENT OF MECHANICAL ENGINEERING**

# III Year B.Tech. ME- I Semester

| S.No | Subject Code | SUBJECT | T | P | CREDITS |
|---|---|---|---|---|---|
| 1 | 15A03501 | Dynamics of Machinery | 4 | 0 | 4 |
| 2 | 15A03502 | Machine Tools | 4 | 0 | 4 |
| 3 | 15A03503 | Industrial Engineering & Management | 4 | 0 | 4 |
| 4 | 15A03504 | Design of Machine Members – I | 4 | 0 | 4 |
| 5 | 15A03505 | Thermal Engineering - II | 4 | 0 | 4 |
| 6 | 15A03506 | Heat Transfer | 4 | 0 | 4 |
| 7 | 15A03507 | Thermal Engineering Lab | 0 | 4 | 2 |
| 8 | 15A03508 | Heat Transfer Lab | 0 | 4 | 2 |
| | 15A55501 | Advanced Communication Skills Lab (Audit) | | 4 | 0 |
| | | Total | 24 | 12 | 28 |

**JNTU COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**

**COURSE STRUCTURE OF**

**MECHANICAL ENGINEERING**

| **III Year B.Tech.M.E. I Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **1** | **0** | **4** |

**DYNAMICS OF MACHINERY (15A03501)**

| **Course Objectives:** To impart knowledge on | |
|---|---|
| 1 | Analysis of forces acting in mechanisms |
| 2 | Effects of unbalance forces |
| 3 | Modeling and analyzing the vibration behavior of spring mass damper system |
| 4 | The principles in mechanisms used for governing of machines |

**UNIT I**

Friction: Inclined plane, friction of screws and nuts, pivot and collar, uniform pressure, uniform wear. Friction circle and friction axis, lubricated surfaces, boundary friction, film lubrication.

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

Brakes And Dynamometers: Simple block brakes, Band brake, internal expanding brake, braking of vehicle. Dynamometers – absorption and transmission types. General description and methods of operation.

**UNIT II**

Precession: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aeroplanes 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 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 inline and radial engines for primary and secondary balancing.

**UNIT V**

Vibration: 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, Raleigh"s method. Torsional vibrations - two and three rotor systems.

| | **Course Outcomes:** Ability to |
|---|---|
| CO1 | Determine the forces acting on various linkages when a mechanism is subjected to external forces. |
| CO2 | Identify and correct the unbalances of rotating body |
| CO3 | Analyze the vibratory motion of SDOF systems. |
| CO4 | Reduce the magnitude of vibration and isolate vibration of dynamic systems |
| CO5 | Determine dimensions of Governors for speed control. |

***Text Books:***

*1. Theory of Machines, S.S. Rattan, MGH Publishers,3rd Edition,2013.*

*2. Kinematics and Dynamics of Machinery R.L. Norton, Tata McGraw Hill.*

***Reference Books:***

*1. Theory of Machines, Thomas Bevan, Pearson, 3rd Edition,2012.*

*2. The theory of Machines, J.E. Shiegley, McGraw Hill .*

*3. Theory of Machines and Mechanisms of Shigley et.al. Oxford International Student Edition.*

*4. Theory of Machines by R.S Khurm, S.Chand Publications*

***NOTE:*** *End Exam should be conducted in Drawing Hall*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 3 | | | | | 1 | | | | 1 | | | | |
| CO2 | 3 | | 1 | 2 | | 1 | | | 1 | 3 | | | 2 | | |
| CO3 | | | | | | | | 1 | | | | 1 | | 3 | |
| CO4 | 3 | | 1 | | 2 | 1 | 1 | | | | 1 | | 2 | | |
| CO5 | | | 1 | | | | | 1 | | 3 | | | | | |

**JNTU COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**

**COURSE STRUCTURE OF**

**MECHANICAL ENGINEERING**

| **III Year B.Tech.M.E. I Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **1** | **0** | **4** |

**MACHINE TOOLS (15A03502)**

| | **Course Objectives:** |
|---|---|
| 1 | To create awareness on various mechanical measuring instruments. |
| 2 | To make student familiar with various operations on machine tools |
| 3 | To make the students familiar with the drilling operations |
| 4 | Usage of the instruments to measure the linear and angular measurements |
| 5 | To gain the practical experience on the machines |

**UNIT I**

Elementary treatment of metal cutting theory – Elements of cutting process – Geometry of single point tool and angles, chip formation and types of chips – built up edge and its effects, chip breakers. Mechanics of orthogonal cutting –Merchant"s Force diagram, cutting forces – cutting speeds, feed, depth of cut, heat generation, tool life, coolants, machinability – economics of machining. cutting Tool materials and cutting fluids –types and characteristics .

**UNIT II**

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 capstan lathes – collet chucks – other work holders – tool holding devices – box and tool layout. Principal features of automatic lathes – classification – Single spindle and multi-spindle automatic lathes– tool layout and cam design.

**UNIT III**

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. Machining time calculations.

**UNIT IV**

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 milling machines.

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. Static and dynamic balancing of a wheel Truing and Dressing of wheels. Lapping, Honing and Broaching machines – comparison of grinding, lapping and honing. machining time calculations.

**UNIT V**

Principles of design of Jigs and fixtures and uses, 3-2-1 Classification of Jigs & Fixtures – Principles of location and clamping – Types of clamping & work holding devices, Typical examples of jigs and Fixtures Unit built machine tools – multispindle heads. power units-principal of working types of UBMTS, characterization, applications.

| | **Course Outcomes:** |
|---|---|
| CO1 | Hands on experience on lathe machine to perform turning, facing, threading operations. |
| CO2 | Practical exposure on flat surface machining, milling and grinding operations. |
| CO3 | Skill development in drilling and threading operations. |
| CO4 | Linear and angular measurements exposure. |
| CO5 | Operation of various machines like lathe, drilling, grinding, slotting, shaping, milling etc |

***Text Books:***

*1. Workshop Technology – Vol II, B.S.RaghuVamshi, Dhanpat Rai & Co, 10th edition, 2013*

*2. Production Technology by R.K. Jain and S.C. Gupta, Khanna Publishers, 17th edition, 2012*

***Reference Books:***

*1. Manufacturing Technology-Kalpakzian- Pearson*
*2. Metal cutting Principles by Milton C.Shaw, oxford Second Edn, 2nd edition, 2012*
*3. Production Technology by H.M.T. (Hindustan Machine Tools),TMH, 1st edition, 2001*
*4. Production Technology by K.L.Narayana, IK International Pub.*
*5. Unconventional Machining process by V.K.Jain, Allied Pub.*
*6. manufacturing technology Vol II by P.N. Rao, Tata McGraw Hill, 4th edition, 2013*
*7. Machining and machine tools by AB. Chattopadyay, WileyEdn,2013*
*8. Machine Technology Machine tools and operations by Halmi A Yousuf&Harson, CRC Press Taylor and Francies .*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | | | 2 | | | 3 | | 3 | | 2 | | 3 |
| CO2 | | 3 | | | | | | | | 3 | | 2 | | 3 | |
| CO3 | 2 | | 3 | | | 2 | | | 2 | | 3 | | | | 3 |
| CO4 | | 3 | | | | | | | | | | 2 | | 3 | |
| CO5 | 1 | | | | | 2 | | | 1 | 3 | | | 2 | | |

**JNTU COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**

**COURSE STRUCTURE OF**

**MECHANICAL ENGINEERING**

| **III Year B.Tech.M.E. I Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **1** | **0** | **4** |

**INDUSTRIAL ENGINEERING & MANAGEMENT (15A03503)**

| | **Course Objectives:** |
|---|---|
| 1. | To impart knowledge on work study techniques towards productivity improvement industrial engineering concepts towards manufacturing management quality engineering and reliability tools. |
| 2. | To impart knowledge on the material management. |

**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 Mc-Gregor‟s Theory X and Y, Mayo's Hawthorne Experiments, Hertzberg‟s Two factor Theory of Motivation, Maslow‟s Hierarchy of Human needs – Systems Approach to Management.

Organizational Structures- Functional- Divisional- Matrix etc., Basic Concepts Related to Organization – Departmentation and Decentralization and their Merits, Demerits and Suitability

**UNIT II**

Plant Location: Definition, Factors affecting the Plant Location, Comparison of Rural and Urban sites, Methods for Selection of Plant – Matrix Approach Plant Layout: Definition, Objectives, Organization, Types of Production, Types of Plant Layout – Various Data Analyzing Forms – Travel Chart, Optimization of Layout-Load Distance Model & CRAFT-Materials Handling Function-Objectives - Types-Selection Criteria of Material Handling Equipment.

**UNIT III**

Work Study – Definition, Objectives, Method Study – Definition, Objectives, Steps Involved – Various Types of Associated Charts – Differences between Micromotion and Memomotion Studies.

Work Measurement - Definition, Time Study, Steps involved - Equipment, Different Methods of Performance Rating - Allowances, Standard Time Calculation. Work Sampling - Definition, Steps Involved, Standard Time Calculations, Differences with Time Study – Applications.

**UNIT IV**

Material Management – Objectives, Inventory – functions, types, associated cost, inventory classification techniques- ABC Analysis; Inventory Models- Deterministic models- EOQ Model – Models with one Price Break and Multiple Price Breaks- shortages are not allowed – Stochastic Models – Demand may be Discrete Variable or Continuous Variable – Instantaneous Production. Instantaneous Demand and Continuous Demand and No Set-up Cost Stores Management and Stores Records- Purchase Management, Duties of Purchase Manager, Associated forms

**UNIT V**

Human Resource Management-Functions of HRM, Job Evaluation, Merit Rating- Difference with Job Evaluation, Different Methods of Merit Ratings, Wage Incentives, Different Types of Incentive Schemes Inspection & Quality Control: Differences between Inspection & Quality Control. 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. Introduction to TQM- Quality circles-BIS & ISO Standards-Importance and Evaluation Procedure Marketing Management- Introduction, Marketing vs Selling, Market Segmentation.

| **COURSE OUTCOMES:** At the end of the course students will be able to | |
|---|---|
| CO1 | Use knowledge and comprehension in management tools to apply in technical organizations. |
| CO2 | To understand where the plant is to be located based on facilities available and plant layout. And also able to understand plant layout design to facilitate material flow and processing of a product in the most efficient manner through the shortest possible time. |
| CO3 | Ability to apply various work study techniques towards productivity improvement apply in IE&M concepts in real life environment for goal achievement. |
| CO4 | To understand the importance and function of inventory and to be able to apply selected techniques for its control and management under dependent and independent demand circumstances, importance of Inventory control to ensure their availability with minimum capital lock up. |
| CO5 | To introduce the basic principles of group dynamics and associated concepts required for HRM in organizations. Design a simple sampling plan, construct its OC curve and evaluate its effectiveness on a given sampling process. TQM circles to find solutions to problems in industry towards continuous improvement in the system. |

***Text Books:***

*1. Manufacturing Organization and Management, T.Amrine/ Pearson, 2nd Edition, 2004*
*2.*

*3. Industrial Engineering and Management, Dr. C.Nadamuni Reddy, New Age International*

*Publishers, 1st edition, 2011.*

***Reference Books:***

*1. Industrial Engineering and production management, MartindTelsang S.Chand.*

*2. Industrial Engineering and Management ,O.P.Khanna, DhanpatiRai, 18th edition, 2013.*
*3. Work Study by ILO(International Labour Organization)*
*4. Management by James AF Stoner, Freeman 6th Ed, Pearson Education, New Delhi,2005*
*5. Production and Operations management, PanneerSelvam, PHI,2004.*
*6. Statistical Quality Control by EL Grantt, McGrawhil*
*7. Motion and time studies by Ralph M Barnes, John Wiley and Sons,2004*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | | 3 | | | 2 | | 2 | | | 3 | | 3 | |
| CO2 | | 3 | | 3 | 2 | | | 3 | | 3 | | | 3 | | 2 |
| CO3 | 3 | | 3 | | | 3 | | 3 | | | 3 | | | | 2 |
| CO4 | | 3 | | | 1 | | 2 | | | 3 | | 3 | | 3 | |
| CO5 | 1 | | 3 | | 3 | 3 | | | 2 | | 3 | | 3 | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU**

| **III Year B.Tech. M.E. I-Sem** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **1** | **0** | **4** |

## DESIGN OF MACHINE MEMBERS-I (15A03504)

| | **Course Objectives:** |
|---|---|
| 1 | To familiarize the various steps involved in the Design Process. |
| 2 | To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements. |
| 3 | To learn to use standard practices and standard data. |
| 4 | To learn to use catalogues and standard machine components. |

**UNIT -I**

Introduction: General considerations of design, design process. Selection of Engineering Materials - properties –Manufacturing considerations in the design. BIS codes of materials, preferred numbers and interchangeability.

Stresses In Machine Members**:** Simple stresses – Combined stresses – Torsional and bending Stresses – impact stresses – stress -strain relation – Various theories of failure – factor of safety.

**UNIT – II**

Design For Fluctuating Loads**:** Stress concentration –notch sensitivity – Design for fluctuating stresses – Endurance limit – Estimation of Endurance strength – Goodman"s line – Soderberg"s line design of components for finite and infinite life.

**UNIT – III**

Design Of Riveted Joints: Types of riveted joints, design of riveted joints. Boiler shell riveting design and eccentric loading design of riveted joints.

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.

**UNIT – IV**

Design Of Cotters And Knuckle Joints**:** Design of Cotter joints: spigot and socket, sleeve and cotter, jib and cotter joints- Knuckle joints

Design Of Shafts: Design of solid and hollow shafts for strength and rigidity – Design of shafts for combined bending and axial loads – Standard shaft sizes.

**UNIT-V**

Design Of Keys And Couplings: Design of Rigid couplings: Muff, Split muff and Flange couplings- Design of flexible couplings.

| | **Course Outcomes:** |
|---|---|
| CO1 | Understand the design process, properties of materials and machining considerations in design and able calibrate the stresses in machine members. |
| CO2 | They are able to know the component behavior subjected to fluctuating loads. |
| CO3 | Analyze the Design of riveted joints and Bolted joints. |
| CO4 | They can understand the design of cotters knuckle joints and also the design of solid and hollow shafts. |
| CO5 | Students are able to know the Design of keys, couplings. |

**Text Books:**

1. Design of Machine Elements, V.B.Bhandari , TMH Publishers,NewDelhi
2. Machine Design,Schaum's series,TMH Publishers, New Delhi
3. Machine Design, R.K.Jain, Khanna Publishers, New Delhi.

**Reference Books:**

1. Machine Design, Sadhu Singh, Khanna Publishers, New Delhi
2. Machine Design, R.S. Kurmi and J.K. Gupta ,S.Chand Publishers, New Delhi
3. Mechanical Engineering Design, Joseph E. Shigely, TMH Publishers, NewDelhi.
4. Design of Machine Elements, M.F.Spotts, PHI Publishers, New Delhi.
5. Machine Design, Pandya and Shah, Charotar Publishers, Anand.
6. Machine Design, R.L. Norton, Tata McGraw Hill Publishers
7. Machine Design by Groover – CBS Publications.

**NOTE: Design data books are not permitted in the examinations.**

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | | | | |
| CO2 | | 2 | | | | | | | | 3 | | | 2 | | |
| CO3 | | | 2 | | | | | | | | | | | | |
| CO4 | | | | | 1 | | 2 | | | 1 | | | 2 | | 1 |
| CO5 | | | | | | | | 1 | | | | | 1 | | |

**JNTU COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**
**COURSE STRUCTURE OF**
**MECHANICAL ENGINEERING**

**III Year B.Tech.M.E. I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**THERMAL ENGINEERING – II (15A03505)**

| | **Course Objectives:** To impart knowledge on : |
|---|---|
| 1 | Steam generators, nozzles, and turbines. |
| 2 | Various Gas Power cycles. |

**UNIT I**

Basic Concepts: Rankine Cycle - Schematic Layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat Addition, Methods to Improve Cycle Performance – Regeneration – Reheating- Combined- Cycles.

**UNIT II**

Boilers: Classification Based on Working Principles & Pressures of Operation - L.P & H.P. Boilers – Mountings and Accessories.

Draught: Classification – Height of Chimney for Given Draught and Discharge, Condition for Maximum Discharge, Efficiency of Chimney – Artificial Draught, Induced and Forced Draught.

**UNIT III**

Steam Nozzles: Function of Nozzle – Applications - Types, Flow through Nozzles, Thermodynamic Analysis – Assumptions -Velocity of Nozzle at Exit-Ideal And Actual Expansion in Nozzle, Velocity Coefficient, Condition for Maximum Discharge, Critical Pressure Ratio.

Criteria for Design of Nozzle Shape: Super Saturated Flow and its Effects, Degree of Super Saturation and Degree of Under Cooling - Wilson Line –Shock at the Exit.

Condensers: Classification, Air Leakage Vacuum Efficiency, condenser efficiency, problems.

**UNIT IV**

Impulse Turbine: Mechanical Details – Velocity Diagram – Effect of Friction – Power Developed, Axial Thrust Blade or Diagram Efficiency – Condition for Maximum Efficiency. De-Laval Turbine – Its Features. Methods To Reduce Rotor Speed - Velocity Compounding And Pressure Compounding, Velocity And Pressure Variation Along The Flow – Combined Velocity Diagram For A Velocity Compounded Impulse Turbine.

Reaction Turbine: Mechanical Details – Principle of Operation, Thermodynamic analysis of a Stage, Degree of Reaction –Velocity Diagram – Parson‟s Reaction Turbine – Condition for Maximum Efficiency.

**UNIT V**

Gas Turbines: Simple Gas Turbine Plant – Ideal Cycle, Essential Components – Parameters of Performance – Actual Cycle – Regeneration, Inter Cooling and Reheating – Closed And Semi-Closed Cycles – Merits and Demerits, Brief Concepts of Compressors, Combustion Chambers and Turbines used in Gas Turbine Plants.

Jet Propulsion: Principle of Operation – Classification of Jet Propulsive Engines – Working Principles with Schematic Diagrams and Representation on T-S Diagram - Thrust, Thrust Power and Propulsion Efficiency – Turbo Jet, Turbo Prop, Pulse Jet Engines – Schematic Diagram, Thermodynamic Cycle. Introduction to Rocket Propulsion.

| | **Course Outcomes:** Ability to |
|---|---|
| CO1 | Students shall be able to know the Basic concepts of rankine cycles and methods to improve the performance. |
| CO2 | Shall acquire knowledge on principles of working accessories and safety features of stream generators. |
| CO3 | Shall acquire knowledge on stream flow through varying areas and capable of solving related problems and to understand functioning of steam condenser. |
| CO4 | To be able to Determine the efficiency of the impulse and reaction turbine using velocity triangles. |
| CO5 | Analyze gas turbines cycles and compare the operational aspects of jet engines. |

***Text Books:***

*1. Basic and Applied Thermodynamics, P.K. Nag, TMH , 2nd Edition,2012.*
*2. Thermal Engineering, R.K. Rajput, 9/e, Lakshmi Publications, 2013*

***Reference Books:***

*1. Gas Turbines, V. Ganesan, TMH*
*2. Thermodynamics and Heat Engines, R.Yadav, Central Publishing House, Allahabad, 2002.*
*3. Gas Turbines and Propulsive Systems, P.Khajuria&S.P.Dubey, Dhanpatrai*
*4. Thermal Engineering, R.S Khurmi & JS Gupta, S.Chand, 2012.*
*5. Thermal Engineering-M.L.Mathur & F.S.Mehta, Jain bros, 2006.*
*6. Thermal Engineering Data Book, B.S. Reddy and K.H. Reddy, I.K. International, 2007.*
*7. Steam Tables SI Units- Dr.B.Umamaheswar Gowd and A. Nagraju, Siri Publ.*

***NOTE:*** *Steam tables and Mollier charts to be supplied for exam.*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | | | 2 | | | | | 3 | | 3 | 2 | | 3 |
| CO2 | | 1 | | | | | | 1 | | | 3 | | | 3 | |
| CO3 | 1 | | | | 2 | | | | | 3 | | 3 | 1 | | 3 |
| CO4 | | 1 | | | | | | | | | 3 | | | 3 | |
| CO5 | 1 | | | | 2 | | | 1 | | 3 | | | | | 3 |

**JNTU COLLEGE OF ENGINEERING (AUTONOMOUS):**
**ANANTAPUR COURSE STRUCTURE OF**
**MECHANICAL ENGINEERING**

| **III Year B.Tech.M.E. I Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **1** | **0** | **4** |

## HEAT TRANSFER (15A03506)

| **Course Objectives:** To impart knowledge on | |
|---|---|
| C3 03.1 | To impart knowledge on Conduction, convection, radiation, heat transfer during boiling To impart knowledge on and condensation. |
| C3 03.2 | Students able to understand Design of heat exchangers. |
| C3 03.3 | To Describe the concepts of one dimensional steady state heat conduction to various co-ordinates system. |
| C3 03.4 | To Define and explain the laws of radiation and its application. |
| C3 03.5 | To know Boundary layer concept, type of convection flow. |

### UNIT I

Introduction: Modes and Mechanisms of Heat Transfer – Basic Laws of Heat Transfer – General Applications of Heat Transfer.

Conduction Heat Transfer: Fourier Rate Equation – General Heat Conduction Equation In Cartesian, Cylindrical and Spherical Coordinates, Simplification and Forms of the Field Equation – Steady, Unsteady and Periodic Heat Transfer – Boundary and Initial Conditions.

One Dimensional Steady State Heat Conduction: In Homogeneous Slabs, Hollow Cylinders and Spheres – Overall Heat Transfer Coefficient – Electrical Analogy – Critical Radius/Thickness of Insulation – With Variable Thermal Conductivity – With Internal Heat Sources or Heat Generation

### UNIT II

Heat Transfer in Extended Surface (Fins) – efficiency, effectiveness and temperature distribution on Long Fin, Fin with Insulated Tip and Short Fin, Application to Errors in Temperature Measurement. One Dimensional Transient Heat Conduction: In Systems with Negligible Internal Resistance- Significance of Biot and Fourier Numbers – Chart Solutions of Transient Conduction Systems – Problems on Semi-infinite Body.

### UNIT III

Convective Heat Transfer: Dimensional Analysis – Buckingham Π Theorem and Its Application for Developing Semi – Empirical Non-Dimensional Correlations for Convective Heat Transfer – Significance of Non-Dimensional Numbers – Concepts of Continuity, Momentum And Energy Equations.

Forced Convection: External Flows: Concepts of Hydrodynamic and Thermal Boundary Layer and Use of Empirical Correlations for Convective Heat Transfer for Flow Over – Flat Plates, Cylinders and Spheres.

Internal Flows: Division of Internal Flow through Concepts of Hydrodynamic and Thermal Entry Lengths – Use of Empirical Relations for Convective Heat Transfer in Horizontal Pipe Flow, Annular Flow.

Free Convection: Development of Hydrodynamic and Thermal Boundary Layer along a Vertical Plate

– Use of Empirical Relations for Convective Heat Transfer on Plates and Cylinders in Horizontal and Vertical Orientation.

**UNIT IV**

Heat Transfer with Phase Change: Boiling: Pool Boiling – Regimes, Determination of Heat Transfer Coefficient in Nucleate Boiling, Critical Heat Flux and Film Boiling.

Condensation: Film wise and Drop wise Condensation – Nusselt's Theory of Condensation on a Vertical Plate – Film Condensation on Vertical snd Horizontal Cylinders Using Empirical Correlations.

Heat Exchangers: Classification of Heat Exchangers – Overall Heat Transfer Coefficient and Fouling Factor –Concepts of LMTD and NTU Methods – Problems using LMTD and NTU Methods.

**UNIT V**

Radiative Heat Transfer: Emission Characteristics and Laws of Black-Body Radiation – Irradiation – Total and Monochromatic Quantities– Laws of Planck, Wien, Kirchoff, Lambert, Stefan And Boltzmann – Heat Exchange Between Two Black Bodies – Concepts of Shape Factor – Emissivity – Heat Exchange Between Gray Bodies – Radiation Shields – Electrical Analogy for Radiation Networks.

| **Course Outcomes:** | |
|---|---|
| **CO1** | To understand the basic laws of heat transfer and electrical analogy. |
| **CO2** | To analyze problems involving steady state heat conduction in simple geometries with and without heat generation and analyze heat transfer situations in extended surfaces. |
| **CO3** | To evaluate heat transfer coefficients for natural and forced convection situations |
| **CO4** | To understand Heat transfer during phase change and estimate heat transfer rates |
| **CO5** | To analyze heat exchanger performance by using LMTD and NTU methods. |
| **CO6** | To calculate radiation heat transfer between black body surfaces and gray body surfaces**.** |

***Text Books:***

*1. Fundamentals of Engg. Heat and Mass Transfer, R.C. Sachdeva, 4/e, New Age International, 2010.*

***Reference Books:***

*1. Heat Transfer, P.K.Nag, 3/e, TMH, 2011*
*2. Heat Transfer, Ghoshdastidar, Oxford Univ. Press, 1st edition, 2004*
*3. Heat Transfer, Holman.J.P, 10/e, TMH, 2012*
*4. Heat and Mass Transfer, R.K.Rajput, S.Chand& Company Ltd, 2001*
*5. Fundamentals of Heat and Mass Transfer, Kondandaraman, C.P., 3/e, New Age Publ.*
*6. Fundamentals of Heat and Mass Transfer, Incropera, 5/e, Wiley India.*
*7. Thermal Engineering Data Book, B.S.Reddy and K.H.Reddy Rev/e, I.K. International, 2007*

***NOTE:*** *Heat transfer Data books are permitted for Exam.*

## Mapping between Course Outcomes and Programme Outcomes

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | | 3 | | 2 | | 2 | | 3 | | 3 | | |
| CO2 | | 3 | | 3 | | 3 | | 3 | | 2 | | 3 | | 3 | 1 |
| CO3 | 3 | | 3 | | 3 | | 3 | | 3 | | | | 3 | | 1 |
| CO4 | | 3 | | 2 | | | | 3 | | 3 | 3 | | | 2 | |
| CO5 | 3 | | | 1 | | | 1 | | 1 | 1 | | 3 | | 1 | |

## JNTU COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR
## COURSE STRUCTURE OF MECHANICAL ENGINEERING

**III Year B.Tech.M.E. I Semester**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

### THERMAL ENGINEERING LAB (15A03507)

| | **Course Objectives:** |
|---|---|
| 1 | To impart knowledge on working principles of various thermal equipments like compressors, IC Engines, Boilers etc., |
| 2 | To study the working principle of IC engines, performance and characteristics in terms of heat balancing, economical speed variations, air fuel ratio etc., |

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, economical speed test.
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.

| | **Course Outcomes:** |
|---|---|
| CO1 | Performance Test on 4-Stroke Diesel and 2-Stroke Petrol engine. |
| CO2 | Able to evaluate the Engine friction of 4-Stroke Multi cylinder Engine and Air/Fuel ratio and Volumetric efficiency of I.C.Engines. |
| CO3 | To calculate the heat balance of the IC Engines. |
| CO4 | To calculate the efficiencies and performance characteristics of the engines. |
| CO5 | Study the boilers and identify parts of the engine parts. |

**JNTUACEA** **R-15**

**2015-16**

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | | | | | | | | | | 3 | | |
| CO2 | | | | | | 3 | | | 2 | | | 3 | | 1 | 2 |
| CO3 | 3 | | 2 | | 2 | | | | | | | | | | |
| CO4 | | 2 | | | | | 3 | | | 3 | | | 3 | | |
| CO5 | | | | | | | | | | | | | | | |

**JNTU COLLEGE OF ENGINEERING (AUTONOMOUS):**
**ANANTAPUR COURSE STRUCTURE OF**
**MECHANICAL ENGINEERING**

| **III Year B.Tech.M.E. I Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **0** | **0** | **3** | **2** |

## HEAT TRANSFER LAB (15A03508)

| | **Course Objectives:** |
|---|---|
| 1 | To impart knowledge on conducting the heat transfer experiments and practically learns how to find heat transfer coefficients, thermal Conductivity, emissivity and effectiveness. |

***NOTE****: Thermal Engineering data books are permitted in the examinations*

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

***Note:*** *Any 10 of the above 15 experiments are to be conducted*

| | **Course Outcomes :** |
|---|---|
| CO1 | Student can prepare the Guarded plate apparatus. |
| CO2 | Student can get the ideas on Lagged pipe apparatus. |
| CO3 | Student can prepare the Natural convection – vertical cylinder, Emissivity measurement and Stefan-Boltzmann apparatus. |
| CO4 | Student can get the ideas on Forced convection inside tube and Parallel/counter flow heat exchanger apparatus. |
| CO5 | Student can prepare the Pin-fin apparatus, Air-conditioning test rig |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | | | 2 | | | | | 3 | | 2 | | 3 |
| CO2 | | 3 | | | 3 | | | | 2 | | | 3 | | 1 | |
| CO3 | 2 | | | | | 2 | | | | | 3 | | | | |
| CO4 | | 3 | | | 3 | | | | 2 | | | | 2 | | 3 |
| CO5 | 1 | | 3 | | | | | | | | | 3 | | 1 | |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**Course Structure**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**III Year B.Tech. ME- II Semester**

| S.No | Code No | SUBJECT | T | P | CREDITS |
|---|---|---|---|---|---|
| 1 | 15A03601 | Metal Forming | 4 | 0 | 4 |
| 2 | 15A03602 | Design of Machine Members – II | 4 | 0 | 4 |
| 3 | 15A03603 | Operations Research | 4 | 0 | 4 |
| 4 | 15A03604 | CAD / CAM | 4 | 0 | 4 |
| 5 | 15A03605 | Automobile Engineering | 4 | 0 | 4 |
| 6 | 15A03606 | **Open Elective**<br>a) Entrepreneurship<br>b) Total Quality Management<br>c) Energy Ecology & Environment | 4 | 0 | 4 |
| 7 | 15A03607 | Machine Tools Lab | 0 | 4 | 2 |
| 8 | 15A03608 | CAD / CAM Lab | 0 | 4 | 2 |
| | | Total | 24 | 8 | 28 |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU**

**III Year B.Tech. M.E. II-Sem** **T P C**
**4 0 4**

## METAL FORMING (15A03601)

| | Course Objectives: |
|---|---|
| 1. | The objective of this course is to teach metal forming theory and technology, limits of the processes, tool design and machinery selection. |

**UNIT 1**

Stress, strain, Two dimensional stress analysis and three dimensional stress analysis, relation between engineering stress and true stress, relation between engineering strain and true strain, yield criteria, yield locus, theory of plasticity, hot working, cold working, strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of Cold and Hot worked parts.

**UNIT II**

Rolling: Bulk deformation processes – Economics of bulk forming, principles and theory of rolling, types of Rolling mills and products. Forces in rolling and power requirements, applications and, limitations, defects in rolled products – machinery and Equipment.

Forging Processes: Principles of forging –types forging, smith forging, drop forging, roll forging, forging hammers, rotary forging, forging defects, forces in forging of strip, disc and power requirements, applications, equipment and their selection.

**UNIT III**

Extrusion Processes: Basic extrusion process and its characteristics, mechanics of hot and cold extrusion, forward extrusion and backward extrusion, impact extrusion hydrostatic extrusion, forces in extrusion of cylindrical and non cylindrical components, characteristics and defects in extruded parts. Wire Drawing: Process Mechanics and its characteristics, determination of degree of drawing, drawing force, power, and number of stages-defects in products.

**UNIT IV**

Sheet Metal Working – Economical considerations, stamping, forming and other cold working processes: blanking and piercing, bending and forming – drawing and its types – cup drawing and tube drawing – coining – hot and cold spinning. Force and power requirement in sheet metal operations, defects in sheet metal products – equipment, tooling and their characteristics.

**UNIT V**

Unconventional machining process: Introduction– EDM, WEDM, ECM, WJM, AJM, AWJM, LBM, EBM, USM – principle, working and applications.

| **COURSE OUTCOMES:** At the end of the course students will be able to | |
|---|---|
| CO1 | Analyse the effect of parameters influencing metal forming and compare hot working and cold working applications . |
| CO2 | Analyse the effect of forces in rolling process to understand the deformation process of rolling. |
| CO3 | Understand the principles of sheet metal working forging and analyse the forces acting in forging and its applications. |
| CO4 | Understand the applications of and their working principles |
| CO5 | Understand the importance and applications of in conventional machining process like EDM,WEDM,ECM,WJM etc. |

***Text Books:***

1. *Manufacturing Technology, Foundry forming and welding, Vol I , P.N. Rao,TMH*
2. *Manufacturing Technology, Schmid and kalpakjin, Pearson Education.*

***Reference Books:***

*1. Production Technology, R.K. Jain, Khanna Publishers,17th edition, 2012*
*2. Process and materials of manufacturing –Lindberg, PE*
*3. Welding Process, R.S. Parmar,* Khanna Publishers, 2010
*4. Manufacturing Technology, R.K. Rajput, Laxmi Publishers*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | 3 | | | | 1 | | | 3 | | 2 | | 1 |
| CO2 | 3 | | 2 | | 3 | | | | 2 | | | 2 | | 3 | |
| CO3 | | 3 | | | | | | | | 2 | | | | 3 | |
| CO4 | 3 | | 2 | | 3 | | | | 2 | | | 2 | | | |
| CO5 | | 1 | | 3 | | | | 1 | | 2 | 3 | | 2 | | 1 |

**JNTU COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**
**COURSE STRUCTURE OF**
**MECHANICAL ENGINEERING**

| **III Year B.Tech. M.E. - II Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **1** | **0** | **4** |

**DESIGN OF MACHINE ELEMENTS– II (15A03602)**

| | **Course Objectives:** |
|---|---|
| 1. | To impart knowledge and skills in applying elementary design principles, basic design procedures and use of design data for the design of mechanical elements. |
| 2. | To provide knowledge about the concepts, procedures and the data, to design and analyse machine elements in power transmission systems. |
| 3. | To impart competency to specify, select and design the mechanical components for transmission systems. |

**UNIT I**

Design Of Curved Beams: Stresses in curved beams, Expression for radius of neutral axis for rectangular, circular, trapezoidal 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 procedure for chain drives.

**UNIT II**

Design Of Mechanical Springs: Stress and deflections of helical Springs-Springs for fatigue loading – Natural frequency of helical springs-Energy storage capacity- Helical Torsion springs- Design of leaf springs.

Design Of Power Screws: Design of screw- Square, ACME and Buttress screws- Efficiency of the screw. Design of compound screw, differential screw, ball screw- possible failures

**UNIT III**

Design Of Bearings: Types of Journal bearings – Lubrication – Bearing Modulus–bearing materials – journal bearing design – Ball and roller bearings – Static loading of ball & roller bearings, bearing life –Failure of bearings.

**UNIT IV**

Design Of Spur & Helical Gears: Spur gears- Helical gears – Load concentration factor – Dynamic load factor. Surface compressive strength – Bending strength – Design analysis of spur and Helical gears – Estimation of centre distance, module and face width. Check for dynamic and wear considerations.

**UNIT V**

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

| | **Course Outcomes :** |
|---|---|
| CO1 | Select suitable belt drives and associated elements from manufacturers catalogues under given loading conditions. Stresses applied in different types of beams. |
| CO2 | Analyze springs and power screws subjected to loading. |
| CO3 | Select suitable bearings and its constituents from manufacturers catalogues under given loading conditions. |
| CO4 | Apply the design concepts to estimate the strength of the gear. |
| CO5 | Select suitable engine parts and associated elements from manufacturers catalogues under given loading conditions. |

***Text Books:***

*1. Mechanical Engineering Design, Joseph E. Shigely, TMH Publishers, New Delhi, 9th edition, 2010.*
*2. Machine Design, R.L. Norton, Tata McGraw Hill Publishers, 2nd edition, 2012.*

***Reference Books:***

*1. Machine Design, Schaum"s series, TMH Publishers, New Delhi, 1st edition, 2011*
*2. Design of Machine Elements, V.B.Bhandari , TMH Publishers, New Delhi, 2nd edition, 2013.*
*3. Machine Design, Sadhu Singh, Khanna Publishers, New Delhi*
*4. Design of Machine Elements, M.F.Spotts, PHI Publishers, New Delhi.*
*5. Machine Design, Pandya and Shah, Charotar Publishers, Anand, 17th edition, 2012.*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | 1 | | 2 | | 2 | | | | 3 | | 3 | |
| CO2 | | 2 | | | 2 | | 2 | | 1 | 1 | 3 | | 3 | | 3 |
| CO3 | 2 | | 3 | 1 | | 2 | | 2 | | | | 3 | | 2 | |
| CO4 | | 3 | | | 1 | | | | 1 | 3 | | | | 1 | 3 |
| CO5 | 1 | | 3 | 3 | 3 | | 2 | | | 2 | 3 | | 3 | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):**
**ANANTAPUR COURSE STRUCTURE OF**
**MECHANICAL ENGINEERING**

| **III Year B.Tech. M.E. – II Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **1** | **0** | **4** |

**OPERATIONS RESEARCH (15A03603)**

| | **Course Objectives:** |
|---|---|
| 1. | To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems. |

**UNIT I**

Introduction to OR and Linear Programming-, OR definition– Classification of Models – Types of Operations Research models.

Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Two–Phase Simplex Method, Big-M Method, Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions;

**UNIT II**

Linear programming-2: Duality- Principle, Economic Interpretation of Duality, Dual Simplex Method.

Transportation Problem – Formulation; Different Methods of Obtaining Initial Basic Feasible Solution- North-West Corner Rule, Least Cost Method, Vogel's Approximation Method.

Optimality Methods-Stepping Stone Method and Modified Distribution (MODI) Method; Special Cases -Unbalanced Transportation Problem, Degenerate Problem; Assignment Problem – Formulation; Optimal Solution -Traveling Salesman problem.

**UNIT III**

Game Theory: Introduction – Minimax (Maximin) Criterion and Optimal Strategy, Saddle Point, Solution of Games with Pure Strategy –Games with Mixed Strategies – 2 X 2 Games – Dominance Principle– Solution by Graphical Method of m X 2 & 2 X n games

Queuing Theory: Introduction –Terminology, Service Channel, Arrival Pattern, Population, Departure Pattern (Service Pattern), Queue Discipline, Birth & Death Process, Balking, Reneging, Jockeying; Single Channel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non-finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with finite queue length and non finite queue length.

**UNIT IV**

Sequencing -Assumptions-n-jobs-2 Machines model, n-jobs-3-machines models.

PERT & CPM: Introduction to Project Management, Activities, Events, Predecessor Relationships, AOA Diagram, 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- Critical Path, Crashing, Optimal Project Duration, Least

Possible Project Duration.

PERT- Probabilistic Model- Various types of Activity Time Estimates, Standard Deviation and Variance of the Activities and Projects, and Probability of Completing the Project within scheduled time

**UNIT V**

Dynamic Programming : Introduction – Bellman‟s Principle of Optimality – Applications of Dynamic Programming- Capital Budgeting Problem – Shortest Path Problem – Solution of Linear Programming Problem by DP.

Replacement and Maintenance Analysis: Introduction – Types of Maintenance, Types of Replacement Problem, Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model.

| | **Course Outcomes :**<br><br>On Successful completion of this program, the students can able to understand: |
|---|---|
| CO1 | Types of OR models, can formulate linear programming problems and can solve LPP by different methods. |
| CO2 | Dual simplex methods and methods used to solve Transportation problems. |
| CO3 | Strategies used in different situations in the games and solve them using various techniques. |
| CO4 | The types of queues, its characteristics and queuing models. |
| CO5 | The sequencing and its types, application of PERT/CPM for project scheduling and concept of crashing the project schedule. |
| CO6 | The Dynamic Programming, Bellman’s Principle of Optimality and its applications and Replacement Problems. |

***Text Books:***

*1. Introduction to Operations Research, H.A.Taha, PHI, 9th edition, 2013.*

*2. Introduction to Operations Research Frederick K. Hiller, Bodhibrata Nag, Preetam Basu, Geralld J. Lieberman, TMH, 9th edition,2011.*

***Reference Books:***

*1. Operations Research by R Panneerselvam, PHI, 2nd edition, 2012.*

*2. Operations Research, Wagner, PHI Publications , 2nd edition.*

*3. Operation Research, J.K.Sharma, MacMilan, 5th edition, 2013.*

*4. Linear Programming, Susy Phillippose, PHI*

*5. Operations Research, A.M.Natarajan, P.Balasubramani,A. Tamilarasi,Pearson Education, 8th edition, 2011.*

*6. Operations Research: Methods & Problems , Maurice Saseini, Arhur Yaspan& Lawrence Friedman*

*7. Operations Research, Dr. C.Nadhamuni Reddy & Sri Gopal Krishna, Kurnool Publishers*

**JNTUACEA** **R-15**

**2015-16**

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 2 | | | 2 | | | | 3 | | 3 | | 3 | |
| CO2 | | 2 | | | 2 | | | | 1 | | 2 | | 2 | | 3 |
| CO3 | 3 | | 2 | | | 3 | | | | 3 | | 3 | | 3 | |
| CO4 | | 3 | | | 2 | | | | 1 | | 2 | | 2 | | |
| CO5 | | 1 | | | | 1 | | | | | | | | | 3 |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):**
**ANANTAPUR COURSE STRUCTURE OF**
**MECHANICAL ENGINEERING**

**III Year B.Tech. M.E. -II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**CAD / CAM (15A03604)**

| | **Course Objectives:** |
|---|---|
| 1. | To impart knowledge on the application of computer in the design and manufacturing. |
| 2. | To impart knowledge on graphical entities of CAD/CAM |
| 3. | To impart fundamental knowledge on computer numerical control. |
| 4 | To train the student to develop part programmes for simple components. |
| 5 | To introduce the philosophy of group technology and its benefits. |
| 6 | To introduce the basics of Flexible Manufacturing Systems and integration of Computer Aided Quality Control with Computer Aided Design and Computer Aided Manufacturing. |
| 7 | To impart the concepts of Computer Aided Process Planning |
| 8 | To introduce the concepts of Computer Integrated Process Planning and trends in manufacturing. |

**UNIT I**

Overview of CAD/CAM: Product cycle, CAD, CAM and CIM. CAD Tools, CAM Tools, Utilization in an Industrial Environment, Evaluation criteria. CAD standards, CAD data structure, Data base management systems.

Computer Graphics: Co-ordinate systems, Graphics package functions, 2D and 3D transformations, clipping, hidden line / surface removal colour, shading.

**UNIT II**

Geometric Modeling: Representation techniques, Parametric and non parametric representation, various construction methods, wire frame modeling, synthetic curves and their representations, surface modeling, synthetics surfaces and their representations.

Solid modeling, solid representation, fundamentals, introduction to boundary representations, constructive solid geometry, analytical solid modeling.

**UNIT III**

Numerical Control: NC, NC Modes, NC Elements, NC Machine tools and their structure, Machining centre, types and features. Controls in NC, CNC systems, DNC systems. Adaptive control machining systems, types of adaptive control.

CNC Part Programming: Fundamentals, NC word, NC Nodes, canned cycles, cutter radius compensation, length compensation, computed assisted part programming using APT: Geometry statements, motion statements, post process statements, auxiliary statements, macro statement program for simple components.

**UNIT IV**

Group Technology & FMS: Part Family, Classification and Coding, advantages & limitations, Group technology machine cells, benefits. FMS: Introduction, components of FMS, material handling systems, Computer control systems, advantages.

Computer Aided Quality Control: Terminology in Quality control, Inspection and testing,

Contact inspection methods - optical and non optical, integration of CAQC with CAD and CIM.

**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. Trends in Manufacturing systems: Concepts of Reconfigurable manufacturing, Sustainable manufacturing and lean manufacturing.

| | **Course Outcomes:** Ability to |
|---|---|
| **CO1** | Use suitable graphical entities to design a product |
| **CO2** | Use CAD software for solid and surface modeling |
| **CO3** | Knowledge of various Numerical Control Systems and tools. |
| **CO4** | Program and operate CNC Machines. |
| **CO5** | Implement coding of parts in Group Technology |
| **CO6** | Understand Flexible Manufacturing Systems and integrate various inspection methods with Computer Aided Design and Computer Aided Manufacturing |
| **CO7** | Implement suitable Computer Aided Process Planning and other sub-systems for a customized setup. |
| **CO8** | Understand about the concepts to develop an integrated production planning systems and the concepts of manufacturing systems. |

***Text Books:***

*1. CAD/CAM, A Zimmers & P.Groover, PE, PHI*

*2. CAD/CAM-Principles and applications, P.N. Rao, TMH, 3rd edition, 2010*

***Reference Books:***

1. *Automated Production Systems and CIM by P.Groover Pearson Education, Limited*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | | | | | | | | 3 | | |
| CO2 | 3 | 3 | | 3 | | | | | 3 | 2 | 2 | | 3 | | |
| CO3 | 2 | 3 | 2 | | | | | 2 | 1 | | 2 | | | 3 | |
| CO4 | 1 | 3 | 2 | 1 | | | | | 1 | | | 3 | | 3 | |
| CO5 | 1 | | | | 2 | | | | | | | | | 3 | |
| CO6 | 1 | | | | 2 | | | 2 | 1 | 1 | 2 | 1 | | 3 | |
| CO7 | 1 | | 1 | | 2 | | | 1 | 2 | 1 | 1 | 2 | 3 | | |
| CO8 | 1 | | 1 | | 1 | | | 1 | 3 | 2 | | 1 | | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):**
**ANANTAPUR COURSE STRUCTURE OF**
**MECHANICAL ENGINEERING**

**III Year B.Tech. M.E. - II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**AUTOMOBILE ENGINEERING (15A03605)**

| **Course Objectives:** | |
|---|---|
| C3 04.1 | To impart knowledge on Automotive chassis structure, transmission and suspension systems. |
| C3 04.2 | To impart knowledge on Engine and its working. |
| C3 04.3 | To impart knowledge on Fuel supply, cooling and lubrication systems. |
| C3 04.4 | To impart knowledge on Thermodynamic systems. |
| C3 04.5 | Ability to get knowledge on pollution standards and its significance. |

**UNIT I**

Introduction: Components of a Four Wheeler Automobile – Chassis and Body – Power Unit – Power Transmission – Rear Wheel Drive, Front Wheel Drive, Four Wheel Drive – Types of Automobile Engines, Engine Construction, Turbo Charging and Super Charging – Oil Filters, Oil Pumps – Crank Case Ventilation.

**UNIT II**

Transmission System: Clutches- Principle- Types: Cone Clutch, Single Plate Clutch, Multi Plate Clutch, Magnetic and Centrifugal Clutches, Fluid Fly Wheel – Gear Box- Types: Sliding Mesh, Constant Mesh, Synchromesh, Epi-Cyclic, Over Drive, Torque Converter.
Propeller Shaft – Hotch – Kiss Drive, Torque Tube Drive, Universal Joint, Differential, Rear Axles

**UNIT III**

Steering System: Steering Geometry – Camber, Castor, King Pin Rake, Combined Angle Toe-In, Center Point Steering. Types Of Steering Mechanism – Ackerman Steering Mechanism, Davis Steering Mechanism, Steering Gears – Types, Steering Linkages.

**UNIT IV**

Suspension System: Objects of Suspension Systems – Rigid Axle Suspension System, Torsion Bar, Shock Absorber, Independent Suspension System.
Braking System: Mechanical Brake System, Hydraulic Brake System, Pneumatic and Vacuum Brake Systems.

**UNIT V**

Emissions from Automobiles – Pollution Standards National and International – Pollution Control– Modern Techniques in automobiles – Multipoint Fuel Injection for SI Engines- Common Rail Diesel Injection, Emissions from Alternative Energy Sources– Hydrogen, Biomass, Alcohols, LPG, CNG - Their Merits And Demerits.
Electrical System: Charging Circuit, Generator, Current – Voltage Regulator – Starting System, Bendix Drive, Mechanism of Solenoid Switch, Lighting Systems, Horn, Wiper, Fuel Gauge – Oil Pressure Gauge, Engine Temperature Indicator.

| | **Course Outcomes :** |
|---|---|
| CO1 | Ability to identify the importance of vehicle frame. |
| CO2 | Ability to understand the thermodynamic principles behind the working of petrol and diesel engines. |
| CO3 | Ability to outline the function and components of clutch and transmission systems. |
| CO4 | Ability to understand the importance of steering and braking systems in automobiles |
| CO5 | Ability to get knowledge on pollution standards and its significance. |

***Text Books:***

*1. Automotive Mechanics – Vol. 1 & Vol. 2, Kirpal Singh, Standard Publishers*

*2. Automobile Engineering BY Joseph Hidner*

***Reference Books:***

*1. Automobile Engineering , William Crouse, TMH, 10th edition, 2006.*

*2. Automobile Engineering ,R.K.Rajput,Laxmi Pub, 1st edition, 2013.*

*3. Automobile Engineering ,K.K.Ramalingam/Scitech Pub, 2nd edition.*

*4. Automotive engines , Newton, Steeds & Garret.*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 2 | | 3 | | 3 | 3 | 3 | | | 3 | 2 | 3 | 1 |
| CO2 | | 3 | 2 | | | 3 | | 3 | | 3 | | | | | 1 |
| CO3 | 3 | | | 3 | | 3 | 3 | | | | 3 | 3 | | | 1 |
| CO4 | | 3 | 2 | | 3 | 3 | | | 3 | 3 | | | 2 | 3 | 1 |
| CO5 | 3 | | 2 | | | | 3 | 3 | 3 | | | 3 | | | 1 |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**
**MECHANICAL ENGINEERING DEPARTMENT**

**III Year B.Tech. M.E. –II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

# ENTREPRENEURSHIP (15A03606a)
**(Open Elective)**

| | **Course Objectives:** |
|---|---|
| **1** | To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively |

**UNIT 1**:
Introduction to Entrepreneurship Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vs Intrapreneur. The Entrepreneurial decision process. Role of Entrepreneurship in Economic Development, Ethics and Social responsibility of Entrepreneurs. Opportunities for Entrepreneurs in India and abroad. Woman as Entrepreneur. Creating and Starting the Venture, Sources of new Ideas, Methods of generating ideas, creating problem solving, product planning and development process.

**UNIT II**:
The Business Plan Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, Using and implementing business plans. Marketing plan, financial plan and the organizational plan, Launching formalities.

**UNIT III**:
Financing and Managing the new venture, Sources of capital, venture capital , angel investment, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls. E-commerce and Entrepreneurship, Internet advertising.

**UNIT IV**:
New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Public issues, rights issues, bonus issues and stock splits. Choosing location and layout, Issues related to Selection of layout.

**UNIT V**:
Production and Marketing Management Thrust of production management, Selection of production Techniques, plant utilization and maintenance, Designing the work place, Inventory control, material handling and quality control. Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing. Global aspects of Entrepreneurship.

| | **Course Outcomes :** |
|---|---|
| **CO1** | Students can able to know the importance of entrepreneurship in economic developments, ethics and its social responsibility |
| **CO2** | They can understand the business plan its scope, implementation in marketing and launching. |
| **CO3** | They can able to know the finance resources, motivating, marketing and internet advertising |
| **CO4** | Students can understand the problems related to selection of layout. |
| **CO5** | They can know the production techniques, inventory and quality control in global aspects |

**Text Books:**

1. Robert Hisrich, & Michael Peters: Entrepreneurship, TMH, 5th Edition
2. Dollinger: Entrepreneurship,4/e, Pearson, 2004.

**References Books:**

1. Vasant Desai: Dynamics of Entrepreneurial Development and management, Himalaya Publishing House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Robert J.Calvin: Entrepreneurial Management, TMH, 2004.
4. Gurmeet Naroola: The Entrepreneurial Connection, TMH, 2001.
5. Bolton & Thompson: Entrepeneurs- Talent, Temperament, Technique, Butterworth Heinemann, 2001.
6. Agarwal :Indian Economy, Wishwa Prakashan 2005.
7. Dutt & Sundaram: Indian Economy. S. Chand, 2005.
8. Srivastava: Industrial Relations & Labour Laws, Vikas, 2005.
9. Aruna Kaulgud: Entrepreneurship Management by. Vikas publishing house, 2003.
10. Thomas W. Zimmerer & Norman M. Scarborough: Essential of Entrepreneurship and small business management, PHI, 4/e, 2005.
11. Mary Coulter: Entrepreneurship in Action, PHI, 2/e, 2005.
12. Kaplan: Patterns of Entrepreneurship, Willey, 2005.
13. ND Kapoor: Industrial Law, Sultan Chand & Sons, 2005.

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | | | | | 2 | | | 1 | | 1 | | | 1 |
| CO2 | | | 1 | | 2 | | 2 | | 2 | | | 1 | 2 | | 1 |
| CO3 | | 2 | | 3 | | | | 3 | | 1 | 2 | | | | |
| CO4 | 1 | | 1 | | | 1 | | | | | | | | 3 | |
| CO5 | | 2 | | | | 1 | 2 | | | | 2 | | | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTAPURAMU**

**MECHANICAL ENGINEERING DEPARTMENT**

**III Year B.Tech. M.E. –II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## TOTAL QUALITY MANAGEMENT (15A03606b)
**(Open Elective)**

| | **Course Objectives:** To impart knowledge on |
|---|---|
| **1** | To facilitate the understanding of Quality Management principles and process. |

**UNIT – I**

TQM – Overview, Concepts, Elements – History-Quality Management Philosophies-Juran, Deming, Crosby , Feigenbaum, Ishikawa– Stages of Evolution– Continuous Improvement – Objectives – Internal and External Customers. Quality Standards – Need for Standardization - Institutions – Bodies of Standardization, ISO 9000 series – ISO 14000 series – Other Contemporary Standards – ISO Certification Process-Third Party Audit

**UNIT – II**

Process Management- Quality Measurement Systems (QMS) – Developing and Implementing QMS – TQM Tools & Techniques- 7 QC Tools- 7 New QC Tools.

Problem Solving Techniques - Problem Solving Process – Corrective Action – Order of Precedence– System Failure Analysis Approach – Flow Chart – Fault Tree Analysis – Failure Mode Assessment and Assignment Matrix – Organizing Failure Mode Analysis – Pedigree Analysis.

**UNIT – III**

Quality Circles – Organization – Focus Team Approach – Statistical Process Control – Process Chart – Ishikawa Diagram – Preparing and using Control Charts.

**UNIT – IV**

Quality Function Development (QFD) – Elements of QFD – Benchmarking-Types-Advantages & Limitations of Benchmarking – Taguchi Analysis – Loss function - Taguchi Design of Experiments, Robust Design, Poka-yoke, Kaizen, Deming Cycle.

**UNIT – V**

Value Improvement Elements – Value Improvement Assault – Supplier Teaming; Business Process Reengineering & Elements of Supply Chain Management. Six Sigma Approach – Application of Six Sigma Approach to various Industrial Situations.

| | |
|---|---|
| **Course Outcomes (COs):** At the end of the course students will be able to | |
| **CO1** | Students understand the importance of the quality, costs of quality, and Basics concepts of quality |
| **CO2** | Able to know the TQM principles, employee involvement, team spirit and PDCA cycle. |
| **CO3** | They can able to understand the management tools like Six Sigma, Bench Marking. |
| **CO4** | Able to know TQM tools like control charts , QFD, Taguchi loss function and TPM. |
| **CO5** | The student would be able to apply the tools and techniques of quality management to manufacturing and services processes |

**TEXT BOOKS:**

1Total Quality Management,DakhBesterfield, Pearson Edu.
2. Total Quality Management, K.ShridharBhat, Himalaya.

**REFERENCE BOOKS:**

1. Quality management, Howard Giltow-TMH
2. Quality management, Evans.
3. Quality management, Bedi

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 2 | | | | 3 | 3 | 2 | 2 | | 3 | 3 | | 3 |
| CO2 | | 2 | | 3 | | 2 | | | | | | | | 2 | |
| CO3 | | | 2 | | | | 3 | | 2 | | | 3 | 3 | | |
| CO4 | 3 | 2 | | 3 | | | | 3 | | | | | 3 | 2 | |
| CO5 | | | 2 | | | 2 | | | | 2 | | 3 | | | 3 |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**
**MECHANICAL ENGINEERING DEPARTMENT**

**III Year B.Tech. M.E. –II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## ENERGY ECOLOGY & ENVIRONMENT (15A03606c)
**(Open Elective)**

| | **Course Objectives:** To impart knowledge on |
|---|---|
| 1 | To facilitate the understanding of ENERGY ECOLOGY. |
| 2 | Understand the concepts of Energy transactions in biosphere |

**UNIT-I**
Energy source for earth – sun – its radiation – its absorption and reflection. Various renewable and non-renewable resources.

**UNIT-II**
Boisphere – Energetic of the biosphere – Concepts of Ecology – Components of Ecosystems.

**UNIT-III**
Energy transactions in biosphere – photo synthesis and producers – Herbivones – Carnivones – decomposers – Energy transfers & food wells.

**UNIT-IV**
Dependence on abiotic systems – biogeochemical cycles. Elements of Environment – Interrelationships in environmental components.

**UNIT-V**
Concepts of pollution and affecting the natural balances in energy systems. Energy concepts for a sustainable world bio – systems.

| **Course Outcomes :** At the end of the course students will be able to | |
|---|---|
| **CO1** | Understand the Energy source from Nature |
| **CO2** | Understand the energy ecology & environment |

**Text Books:**
1. Ecology and Environment, P.D. Sharma Rastogi Publications.
2.A Textbook of Energy Ecology, Environment And Society A. Maheshwari, Geeta Parmer Anmol Publications Pvt. Limited.

**Reference Books:**
1. Renewable Energy, Environment and Development, Maheshwar Dayal, Konark Publishers Pvt. Ltd.,

2. Energy for a sustainable world, J.Goldenberg, T.B. Johnson, Amulya K.Reddy & Robert Williams Willey Eastern Ltd.,
3. Concepts of Ecology, E.J.Kormondal , Prentice Hall India Ltd.,

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | 3 | | | | | | | | | | | 2 | |
| CO2 | | 1 | | | | | | | | | | | | | |

**JNTUACOLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**

**COURSE STRUCTURE OF**

**MECHANICAL ENGINEERING**

**III Year B.Tech. M.E. II-Sem**

| L | T | P | C |
|---|---|---|---|
| 0 | | 0 | 3 | 2 |

## MACHINE TOOLS LAB (15A03607)

| | **COURSE OBJECTIVES:** |
|---|---|
| 1 | The course provides students with fundamental knowledge and principles in material removal processes. |
| 2 | To demonstrate the fundamentals of machining processes and machine tools. |
| 3 | In this course, the students apply the fundamentals and principles of metal cutting to practical applications through multiple labs using lathes, milling machines, grinding machines, and drill presses, injection moulding machine etc. |
| 4 | To develop knowledge and importance of metal cutting parameters. |
| 5 | To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms. |

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.

**List of Experiments:**

1. Job on Step turning and
2. 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 and Planning
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.
10. Study of Injection Moulding Machine.

| | **COURSE OUTCOMES**<br><br>Upon successful completion of this course, the students will be able to |
|---|---|
| CO1 | Select appropriate machining processes and conditions for different metals. |
| CO2 | Use different machine tools to remove unwanted material from the work piece to produce final shape. |
| CO3 | Use appropriate grinders to give smooth surface for improving the quality of the object. |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 3 | | | | 2 | | | | | | | | | |
| CO2 | | | 3 | | | | | | | 2 | | 2 | | 3 | |
| CO3 | 2 | | | | 3 | | | 3 | | | | | | | 2 |
| CO4 | | 3 | | | | 2 | | | | | 3 | 2 | 2 | | |
| CO5 | | | | | | | | | | | | | | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):**

**ANANTAPUR COURSE STRUCTURE OF**

**MECHANICAL ENGINEERING**

| **III Year B.Tech. M.E. - II Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **0** | **0** | **3** | **2** |

**CAD / CAM LAB (15A03608)**

| | **Course Objectives:** To impart the knowledge on the |
|---|---|
| **1** | Usage of computer in design and Manufacturing. |
| **2** | Visualization of objects in three dimensions and producing orthographic views, sectional views and auxiliary views of it. |

1. **Drafting:** Development of part drawings for various components in the form of orthographic and isometric. Representation of Dimensioning and tolerances scanning and plotting. Study of script, DXE AND IGES FILES.

2. **Part Modeling:** Generation of various 3D Models through Protrusion, revolve, shell sweep. Creation of various features. Study of parent child relation.

3. **Assembly modeling:** Feature based and Boolean based modeling surfaces, Assembly Modeling of simple components and Design of simple components.

. 4. **CAM:**

a). Study of various post processors used in NC Machines.

b). Development of NC code for free form and sculptured surfaces using CAM packages.

c). Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM packages. Through RS 232.

**Any Four Software Packages from the following:**

Use of Auto CAD, Micro Station, CATIA, Pro-E, I-DEAS, , CAEFEM, Gibbs CAM, Master CAM etc,

| | |
|---|---|
| | **Course Outcomes :**<br>At the end of the course students will be able to |
| **CO1** | Use the coordinate systems for the concerned drawings. |
| **CO2** | Construct 2-D sketches, interpret the dimensions and the associated annotations in CAD environment |
| **CO3** | Construct 2-D sketches for intersections of solids using CAD packages. |
| **CO4** | Create solid models of various objects and machine parts |
| **CO5** | Construct 3-D modeling by extrusion process using various CAD packages. |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | 2 | | | | 2 | | | | | 3 | |
| CO2 | | 3 | | 3 | | | | 3 | | | | | 2 | | 3 |
| CO3 | 3 | | | | 3 | | | | 2 | | | | | 3 | |
| CO4 | | 2 | | 3 | | | | 3 | | | | | 2 | | 2 |
| CO5 | | 1 | | | 1 | | | | 2 | | | | 2 | | 1 |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**

**Course Structure**

**DEPARTMENT OF MECHANICAL ENGINEERING**

**IV Year B.Tech. ME- I Semester**

| S.No | Subject Code | SUBJECT | T | P | CREDITS |
|---|---|---|---|---|---|
| 1 | 15A03701 | Finite Element Methods | 4 | 0 | 4 |
| 2 | 15A03702 | Refrigeration & Air Conditioning | 4 | 0 | 4 |
| 3 | 15A03703 | Instrumentation & Control Systems | 4 | 0 | 4 |
| 4 | 15A03704 | Automation & Robotics | 4 | 0 | 4 |
| 5 | 15A03705 | Engineering Metrology | 4 | 0 | 4 |
| 6 | 15A03706 | **Elective – I (MOOC)** | 4 | 0 | 4 |
| 7 | 15A03707 | Instrumentation & Metrology Lab | 0 | 4 | 2 |
| 8 | 15A03708 | CAE Lab | 0 | 4 | 2 |
| 9 | 15A03709 | Project Work Part-A | 0 | 2 | 0 |
| | | Total | 24 | 10 | 28 |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):**

**ANANTAPUR COURSE STRUCTURE OF**

**MECHANICAL ENGINEERING**

| **IV Year B.Tech. M.E. -I Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **1** | **0** | **4** |

## FINITE ELEMENT METHODS (15A03701)

| **Course Objectives:** | |
|---|---|
| To impart knowledge on | |
| C4 05.1 | Students understand the concepts, and various numerical analysis methods in FEM (for elasticity and thermal problems), to perform finite element formulations for simple engineering problems. |
| C4 05.2 | Students evaluate the field variables for members of 1D geometry and bars, trusses, beams and frames using stiffness and shape function equations |
| C4 05.3 | Students develop polynomial equation for different types of elements and solve problems on interpolation models in different coordinate systems pertaining to higher order and iso parametric elements. |
| C4 05.4 | Students solve the problems on numerical integration Gaussian Quadrature and Axisymmetric elements. |
| C4 05.5 | Students apply the knowledge to solve problems on steady state heat flow and fluid flow problems inID &2D |

### UNIT I

Introduction: Equilibrium equations in elasticity subjected to body force, traction forces and point loads, stress strain relations in 3D elasticity, plane stress and plane strain, Boundary conditions, Initial conditions. Governing equation for Steady state heat conduction with convective boundary conditions. Approximate methods for solving the differential equations: Rayleigh-Ritz method, Weighted residual methods, Galerkin's method.

Integral formulation: Principle of a minimum potential energy, principle of virtual work, Generalized Finite element approach in solving these problems. Solution methods for solving simultaneous equations.

### UNIT II

Problems with One-dimensional geometry: Bars: Formulation of stiffness matrix, Load vectors, Incorporation of boundary conditions: Elimination approach and penalty approach.

Trusses: Plane truss and space truss elements, Example problems involving plane truss elements. Examples involving multipoint constrains. Stress calculations. Beams & Frames: Bending of beams, Interpolation functions, formulation of stiffness matrix and load vectors. Plane frames, space frames. Transformations of stiffness and load vectors.

### UNIT III

Interpolation Models: Polynomial form of interpolation functions - linear, quadratic and cubic, simplex, complex, Multiplex elements, Selection of the order of the interpolation

polynomial, Convergence requirements, 2D Pascal Triangle, Linear interpolation polynomials in terms of global coordinates for triangular (2D simplex) elements, Linear interpolation polynomials in terms of local, coordinates for triangular (2D simplex) elements, quadrilateral element.

Higher Order And Isoparametric Elements: Lagrangian interpolation, Higher order one dimensional elements- quadratic, Cubic element and their shape functions, properties of shape functions, Shape functions of 2D quadratic triangular element in natural coordinates, 2D quadrilateral element shape functions – linear, quadratic, Biquadric rectangular element Tetrahedral and hexahedral elements.

**UNIT IV**

Finite Element Application In Solid Mechanics: Problem modelling and Finite element analysis in 2D plane elasticity with triangular and quadrilateral elements, Iso-parametric, sub-parametric and super- parametric elements. Interpolation, Jacobian, matrices relating strain and nodal displacements, stiffness matrix formulation, Consistent and lumped load vectors, Numerical integration Gaussian quadrate.

Axi-symmetric triangular elements: formulation of stiffness and load

vectors. Introduction to 3D stress analysis.

**UNIT V**

Heat Transfer And Fluid Mechanics Problems:

Steady state heat conduction with convective and heat flux boundary conditions, Functional approach, Galerkin approach formulation of element characteristic matrices and vectors in 1D and 2D problems, Temperature distribution in composite walls one dimensional and two dimensional fins and extended surfaces, Two dimensional potential flow problems: Potential function formulation and stream function formulation.

| **Course Outcomes :**After the completion of the course, the student will be | |
|---|---|
| CO1 | Familiar with the concepts, principles and various numerical analysis methods in FEM (for elasticity and thermal problems), to perform finite element formulations for simple engineering problems. |
| CO2 | Able to evaluate the field variables for members of 1D geometry and bars, trusses, beams and frames using stiffness and shape function equations |
| CO3 | Able to write polynomial equation for different types of elements and solve problems on interpolation models in different coordinate systems pertaining to higher order and isoparametric elements. |
| CO4 | Familiar with triangular and quadrilateral elements and solve problems on numerical integration Gaussian Quadrature and Axisymmetric elements. |
| CO5 | Able to solve problems on steady state heat flow and fluid flow problems inID &2D |

***Text Books:***

*1. Introduction to Finite Element in Engineering, TirupatiChandrapatla and Bellagundu , Pearson Education, New Delhi.*

*2. Finite Element Methods, S. S. Rao , Pergamom Press, New York*

***eference Books:***

*1. Introduction to FEM, J. N. Reddy, TMH Publishers, New Delhi.*

*2. Finite Element Analysis, C.S. Krishna Moorthy, TMH Publishers, New Delhi.*

*3. Fundamentals of Finite Element Analysis, David V. Hutton , TMH Publishers, New Delhi.*

*4. Introduction to the Finite Element Methods, Desai and Abel , CBS Publishers, New Delhi.*

*5. Finite and Boundary Methods in Engineering, O.P.Gupta, Oxford and IBH Publishers, New Delhi.*

*6. Finite Element Modeling for Stress Analysis, R. D. Cook, John. Wiley & Sons, 1995.*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | 3 | | | | 1 | | 2 | | | | 3 | |
| CO2 | 3 | | 2 | | 3 | | | | 2 | | 3 | 2 | | | 1 |
| CO3 | | 2 | | 3 | | | | | | | | | 2 | 3 | |
| CO4 | 3 | | | | | | | | 2 | 2 | | | | | 1 |
| CO5 | | 2 | 2 | | | | | | | | | 2 | 2 | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**

**COURSE STRUCTURE OF MECHANICAL ENGINEERING**

| **IV Year B.Tech. M.E. - I Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **1** | **0** | **4** |

## REFRIGERATION AND AIR CONDITIONING (15A03702)

| | **Course Objectives:** To impart knowledge on |
|---|---|
| 1 | Working principle of refrigeration and air-conditioning cycle. |
| 2 | Fundamentals of psychrometry. |
| 3 | Applications of refrigeration and air-conditioning. |

### UNIT I

Introduction to Refrigeration: Necessity and Applications, Carnot Refrigerator, First and Second Law Applied to Refrigerating Machines, Unit of Refrigeration, COP, EER, Different Refrigeration Methods Air Refrigeration: Bell-Coleman Cycle, Ideal and Actual Cycles, Open and Dense Air Systems - Refrigeration Needs of Air Crafts.

### UNIT II

Vapour Compression Refrigeration ( VCR ) System – Basic Cycle - Working Principle and Essential Components of The Plant – COP – Representation of Cycle On T-S and P-h Charts – Expander Vs. Throttling, Effect of Sub Cooling and Super Heating – Cycle Analysis – Actual CycleRefrigerants – Desirable Properties – Classification of Refrigerants Used – Nomenclature- Secondary Refrigerants- Lubricants – Ozone Depletion – Global Warming- Newer Refrigerants.

### UNIT III

Vapor Absorption Refrigeration ( VAR ) System – Description and Working of NH3 – Water System and Li Br –Water ( Two Shell & Four Shell) System -Calculation of Max COP, Principle of Operation of Three Fluid Absorption System.

Steam Jet Refrigeration System: Working Principle and Basic Components-Estimation of Motive Steam Required, Principle and Operation of: (I) Thermo-Electric Refrigerator (Ii) Vortex Tube OrHilsch Tube.

### UNIT IV

Introduction to Air Conditioning: Psychrometric Properties & Processes – Characterization of Sensible and Latent Heat Loads — Need For Ventilation, Consideration of Infiltrated Air – Heat Load Concepts.Air Conditioning Systems: Air Cooler (Evaporative Cooling) ,Window, Split, Summer , Winter, Year Round, Central Air Conditioning Systems.

**UNIT V**

Air Conditioning Equipment - Humidifiers – Dehumidifiers – Air Filters, Fans and Blowers.

Human Comfort: Requirements of Temperature, Humidity And Concept of Effective Temperature, Comfort Chart.Heat Pump – Heat Sources – Different Heat Pump Circuits.

| | **Course Outcomes:** |
|---|---|
| CO1 | Ability to understand various refrigeration systems. |
| CO2 | Ability to demonstrate the working of refrigeration equipments. |
| CO3 | Ability to understand various psychometric processes. |
| CO4 | Ability to design the space cooling load. |
| CO5 | Ability to explain the air-conditioning equipment. |

***Text Books:***

*1. Refrigeration and Air Conditioning ,CP Arora,TMH, 15th edition, 2013.*

*2. A Course in Refrigeration and Air conditioning, S.C Arora & Domkundwar, Dhanpatrai*

***Reference Books:***

*1. Refrigeration and Air Conditioning / Manohar Prasad / New Age, 2nd edition, 2013*

*2. Principles of Refrigeration - Dossat / Pearson Education, 4th edition, 2007.*

*3. Refrigeration and Air Conditioning-P.L .Ballaney, 2nd edition, 2012.*

*4. Basic Refrigeration and Air-Conditioning – P.N. Ananthanarayanan / TMH, 4th edition, 2013.*

***NOTE:*** *Tables/Codes: Thermal Engineering Data Book containing Réfrigérant and Psychrometric property Tables and charts are permitted in Exam*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | 2 | 3 | | | | | 1 | 2 | | 3 | 2 | 1 |
| CO2 | | 3 | 2 | | | 2 | | | | | | 1 | | | |
| CO3 | 3 | | | 2 | 3 | | | | | 1 | 2 | | 3 | | 1 |
| CO4 | | | 2 | | | 2 | | | | | 2 | 1 | | | |
| CO5 | | 3 | | 2 | 3 | | | | | 1 | | | 3 | 2 | 1 |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):**
**ANANTAPUR COURSE STRUCTURE OF**
**MECHANICAL ENGINEERING**

| **IV Year B.Tech. M.E. -I Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **1** | **0** | **4** |

**INSTRUMENTATION AND CONTROL SYSTEMS (15A03703)**

| | **Course Objectives:** To impart knowledge on |
|---|---|
| **1** | Measurement techniques for measuring process parameters in industry and in research. |
| **2** | Knowledge in measuring parameters like speed, position, velocity, pressure, force, torque, temperature etc. |

**UNIT-I**

Definition - Basic principles of measurement - Measurement systems, generalized configuration and functional descriptions of measuring instruments - examples. Dynamic performance characteristics - sources of error, Classification and elimination of error.

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

**UNIT-II**

Measurement Of Temperature: Classification - Ranges - Various Principles of measurement - Expansion, Electrical Resistance - Thermistor - Thermocouple - Pyrometers - Temperature Indicators. Measurement Of Pressure: Units - classification - different principles used- Manometers, Piston, Bourdon pressure gauges, Bellows - Diaphragm gauges. Low pressure measurement - Thermal. conductivity gauges - ionization pressure gauges, Mcleod pressure gauge.

**UNIT - III**

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

Measurement of Acceleration and Vibration: Different simple instruments - Principles of Seismic instruments - Vibrometer and accelerometer.

Stress & Strain Measurements: Various types - electrical strain gauge - gauge factor - method of usage of resistance strain gauge for bending, compressive and tensile strains - usage for measuring torque, Strain gauge Rosettes.

**UNIT -IV**

Measurement Of Level: Direct method - Indirect methods - capacitative, ultrasonic, magnetic, cryogenic fuel level indicators - Bubler level indicators.

Flow Measurement: Rotameter, magnetic, Ultrasonic, Turbine flow meter, Hot - wire anemometer Laser Doppler Anemometer (LDA).

Measurement Of Humidity - Moisture content in the gases, sling psychrometer, Absorption psychrometer, Dew point meter.

**UNIT - V**

Measurement Of Force, Torque And Power- Elastic force meters, load cells, Torsion meters, Dynamometers.

Elements Of Control Systems: Introduction, Importance - Classification - Open and closed systems Servomechanisms-Examples with block diagrams-Temperature, speed & position control systems.

| | **Course Outcomes):** |
|---|---|
| CO1 | Understand the basic principles and performance characteristics of measurement. |
| CO2 | Apply the basic principles to measure the temperature, pressure with the help of Thermocouple and different pressure gauges |
| CO3 | Student can able to measure Speed, Acceleration and Vibration with the help of various instruments |
| CO4 | Student can able to understand the measurement of Fuel level, measurement of Flow and Humidity, Measure the parameters like Force, Torque, Power and also understand the basic principles, and applications of various control systems |
| CO5 | After completion of the course the student can select appropriate device for the measurement of parameters like temperature, pressure, speed, stress, humidity, flow velocity etc., and justify its use through characteristics and performance. |

**TEXT BOOKS:**

1. Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhaneshl TMH
2. Mechanical Measurements *I* Beckwith, Marangoni, Linehard, Phi/ PE

**REFERENCES:**

1. Instrumentation, measurement & analysis by B.C.Nakra & KKChoudhary, TMH
2. Measurement Systems: Applications & design by D.S Kumar.
3. Instrumentation and Control systems/ S.Bhaskar/ Anuradha Agencies.
4. Mechanical and Industrial Measurements / R.K. *Jain/*Khanna Publishers.
5. Instrumentation & mech. Measurements by AK. Tayal ,Galgotia Publications
6. Mechanical Measurements /Sawhani

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | 3 | | | 2 | | | | 1 | | 2 | 2 | | 1 |
| CO2 | 2 | | | 2 | 3 | | | 1 | | | 2 | | | 3 | |
| CO3 | | 2 | | | | 2 | | | | 1 | | 2 | 2 | | 1 |
| CO4 | | | | 2 | | | | 1 | | | 2 | | | 3 | |
| CO5 | | 2 | | | | | | | | 1 | | | | | 1 |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**

**COURSE STRUCTURE OF MECHANICAL ENGINEERING**

| **IV Year B.Tech.M.E. I Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **1** | **0** | **4** |

## AUTOMATION & ROBOTICS (15A03704)

| | **Course Objectives:**<br><br>To impart knowledge on |
|---|---|
| **1** | Basic principles of automation, tool transfer and implementation of automated flow line |
| **2** | Design aspects and analysis of material handling system |
| **3** | ways of improving line balance and solving line balancing problems |
| **4** | Components, sensing elements used programming techniques and Applications of robots. |
| **5** | Fundamentals of Robotics and primary actuating systems, sensors and transducers. |

**UNIT I**

Introduction to Automation: Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation, Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

**UNIT II**

Automated flow lines: Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines.

Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

**UNIT III**

Introduction to Industrial Robotics: Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers.

Robot actuators and Feedback components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

**UNIT IV**

Manipulator Kinematics: Homogenous transformations as applicable to rotation and transition - D-H notation, Forward inverse kinematics.

Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton – Euler formations. Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

**UNIT V**

Robot Programming: Methods of programming - requirements and features of programming languages, software packages. Problems with programming languages.

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

| | **Course Outcomes:** Ability to |
|---|---|
| **CO1** | Implement the concepts of a productive system in automation |
| **CO2** | Apply the knowledge of automated flow lines for industrial and other applications. |
| **CO3** | Design and analysis of material handling systems for automated assembly lines. |
| **CO4** | Balance automated assembly lines. |
| **CO5** | Design and develop Robot with basic drivers and controllers. select suitable Sensors and transducers for real life or industrial problems. |

***Text Books:***

*1. Automation , Production systems and CIM,M.P. Groover /Pearson Edu.*
*2. Industrial Robotics - M.P. Groover, TMH.*

***Reference Books:***

*1. Robotics , Fu K S, McGraw Hill, 4th edition, 2010.*
*2. An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.*
*3. Robotic Engineering , Richard D. Klafter, Prentice Hall*
*4. Robotics, Fundamental Concepts and analysis – Ashitave Ghosal ,Oxford Press, 1/e, 2006*
*5. Robotics and Control , Mittal R K &Nagrath I J , TMH.*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 3 | | 1 | | | | 3 | | 1 | | 1 | | 1 | |
| CO2 | 1 | | | | 3 | | 3 | | 1 | | 1 | 1 | | | 3 |
| CO3 | | | 3 | | | | | | 1 | | | | | 1 | |
| CO4 | | 3 | | 1 | | 1 | | | | | 1 | | 3 | | 3 |
| CO5 | | | 3 | | 3 | 1 | 3 | 3 | | 1 | | | 3 | | |

## JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR
## COURSE STRUCTURE OF MECHANICAL ENGINEERING

**IV Year B.Tech. M.E. - I Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

### ENGINEERING METROLOGY (15A03705)

| | **Course Objectives:** |
|---|---|
| **1** | To introduce the science of measurement and measuring machines commonly used. |
| **2** | To impart knowledge about limits, fits and tolerances, geometric dimensioning aspects |
| **3** | To introduce the methods of acceptance test for conventional machine tools. |
| **4** | To familiarize students with the concepts of Laser metrology and surface roughness. |

**UNIT I**

Limits, Fits And Tolernces : Introduction, Definitions, fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – inter-changeability 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 rinciple. Design of Go and No Go gauges.

Comparators: Principle of Measurement with Mechanical, Optical, Electrical, Electronic, Pneumatic Comparators and their uses.

**UNIT II**

Linear Measurement: Length standard, line and end & wavelength standards, slip gauges – calibration of the slip gauges, Dial indicator, micrometers, Vernier height gauges.

Measurement Of Angles And Tapers: Different methods – Bevel protractor – angle gauges – spirit levels – sine bar – Sine plate, rollers and spheres used to determine the tapers.

Flatness Measurement: Measurement of flatness of surfaces – straight edges– surface plates – optical flat and auto collimators, interferometer and their uses.

**UNIT III**

Surface Roughness Measurement: Differences between surface roughness and Surface waviness-Numerical assessment of surface finish – CLA, R.M.S Values – Ra , Rz values, Methods of measurement of surface finish-profilograph, Talysurf, BIS symbols for indication of surface finish.

Screw Thread Measurement: Elements of measurement – errors in screw threads – measurement of effective diameter, angle of thread and thread pitch- profile thread gauges.

Gear Measurement: Gear measuring instruments, Gear tooth profile measurement.

Measurement of diameter, pitch, pressure angle and tooth thickness.

Machine Tool Alignment Tests: Requirements of Machine Tool Alignment Tests, Alignment tests on lathe, milling and drilling machine tools. Preparation of acceptance charts.

**UNIT IV**

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

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

Stress & Strain Measurements: Various types - electrical strain gauge - gauge factor – method of usage of resistance strain gauge for bending, compressive and tensile strains - usage for measuring torque, Strain gauge Rosettes.

Measurement Of Acceleration And Vibration: Different simple instruments – Principles of Seismic instruments - Vibrometer and accelerometer.

**UNIT V**

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

Measurement Of Pressure And Sound: Standards and calibration, basic methods of pressure measurement, dead weight gauges and manometers, Elastic transducers, vibrating cylinder, resonant transducers, High and low pressure measurement, sound measurement.

Measurement Of Force, Torque, Power: Standards and calibration, Basic methods of Force Measurement, Torque measurement on rotating shafts, shaft power Measurement(dynamometers), Vibrating wire force transducers.

| **Course Outcomes :** At the end of the course students will be able to | |
|---|---|
| **CO1** | Design tolerances and fits for selected product quality and able to measure the parts with various comparators |
| **CO2** | Use instruments for linear, angular and flatness measurement |
| **CO3** | Choose appropriate method and instruments for inspection of various elements of surface roughness, surface finish, gears and threads and the quality of the machine tool with alignment test can also be evaluated by them |
| **CO4** | Build sound knowledge about various transducers working and its applications for various measurements such as displacement, speed, stress-strain, acceleration and vibration. |
| **CO5** | Know different techniques to measure temperature, pressure, sound, force, torque and power |

***Text Books:***

*(1) Mechanical Measurements, Beckwith, Marangoni, Linehard, PHI, PE*

*(2) Measurement systems: Application and design, Doeblin Earnest. O. Adaptation by Manik and Dhanesh, TMH,2012.*

*(3) Engineering Metrology, R.K. Jain, Khanna Publishers, 20th edition, 2013.*

***Reference Books:***

*(1) Engineering Metrology, Mahajan, Dhanpat Rai, 2nd edition, 2013.*
*(2) BIS standards on Limits & Fits*
*(3) Fundamentals of Dimensional Metrology, Connie Dotson ,4e, Thomson*
*(4) Metrology & Measurement by Anand K Bewoor, vinay A kulkarni, Mc GrawHill, 2013.*
*(5) Instrumentation, measurement & analysis ,B.C.Nakra & K K Choudhary, TMH, 6th edition, 2011.*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 2 | | 2 | 1 | | | | 3 | 1 | 2 | 3 | | 3 |
| CO2 | | 3 | | 3 | | | | | 1 | | | | | 2 | |
| CO3 | | | 2 | | | 1 | | | | 2 | | 3 | | | 3 |
| CO4 | 3 | | | | 2 | | | | 1 | | 1 | 1 | 3 | 3 | |
| CO5 | | 3 | 2 | | | | | | | 1 | | | | 1 | |

. **JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):**
**ANANTAPUR COURSE STRUCTURE OF**
**MECHANICAL ENGINEERING**

**IV Year B.Tech. M.E. I-Sem**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 3 | 2 |

## INSTRUMENTATION & METROLOGY LAB (15A03707)

| | **Course Objectives:** To impart knowledge on |
|---|---|
| **1** | Working principles of linear and angular measuring instruments |
| **2** | Measurement of linear and angular dimensions of a typical work piece specimen using the measuring instruments |
| **3** | Methods of form measurements |

**Section A**

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

**Section B**

1. Measurement of lengths, heights, diameters by vernier calipers, micrometers etc.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear teeth, vernier calipers and checking the chordal addendum and chordal height of spur gear.
4. Alignment test on the lathe.
5. Alignment test on milling machine.
6. Study of Tool makers microscope and its application
7. Angle and taper measurements by Bevel protractor, Sine bars, etc.
8. Use of spirit level in finding the flatness of surface plate.
9. Thread measurement by Two wire/ Three wire method.
10. Surface roughness measurement by Talysurf instrument.
11. Surface Wear Resistances Test using Electro Spark Coating Device.

| | |
|---|---|
| **Course Outcomes (COs):** Upon successful completion of the labs associated with this theoretical course students will be able to | |
| **CO1** | Demonstrate knowledge and understanding of instruments as well as the operating principles of measuring instruments |
| **CO2** | Force measurement using strain gauge. |
| **CO3** | Measurement of displacement by using light Dependent Resistor |
| **CO4** | Measurement of Speed with the help of Transducer |
| **CO5** | Calibration of Temperature and unknown weight by using Thermocouple and Load cell respectively. |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | | 3 | | | | | 3 | | 3 | | 2 | | |
| CO2 | | | 3 | | | | | 3 | | 3 | | 3 | | 1 | 2 |
| CO3 | 2 | | | 2 | | | | | | | | | 3 | | 2 |
| CO4 | | | 3 | | | | | | 3 | | 3 | | | 1 | |
| CO5 | 2 | | | 1 | | | | 3 | | 3 | | 3 | 1 | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**

**MECHANICAL ENGINEERING**

**IV Year B.Tech. M.E. I-Sem**

| **L** | **T** | **P** | **C** |
|---|---|---|---|
| **0** | **0** | **3** | **2** |

## COMPUTER AIDED ENGINEERING LAB (CAE LAB) (15A03708)

| | **Course objectives:** To impart knowledge on |
|---|---|
| **1** | Fundamental knowledge on using software tools like ANSYS, FLUENT, etc., for Engineering Simulation |
| **2** | Knowledge on how these tools are used in Industries for solving real time problems |
| **3** | Understanding about various fields of engineering where these tools can be effectively used to improve the output of a product. |

I. Introduction to Analysis Software Package

II. Structural analysis: (Any four exercises)

1. Analysis of a rectangular plate with a hole.
2. Analysis of a truss member under loading.
3. Analysis of a bracket plate with axial loading
4. Analysis of a bracket plate with eccentric loading
5. Static Analysis of Prismatic bar
6. Static Analysis of a Corner Bracket
7. Static Analysis of beam
8. Analysis of Thermally Loaded support Structure
9. Analysis of Hinged support member
10. Analysis of Tapered plate under transverse load

III. Thermal analysis:(Any two exercises)

1. Analysis of a square plate considering conduction.
2. Analysis of a square plate considering conduction and convection.
3. Analysis of a compound bodies considering conduction and convection.

IV. Computational Fluid Dynamics (Any two exercises)

1. Determine the flow of incompressible gas through an S-bend for laminar flow.
2. Determine the flow of incompressible gas through an S-bend for turbulent flow.
3. Determine that of incompressible water flowing over a cylinder.
4. Determine air flow over a simple geometry (aerofoil) in a wind tunnel (2-D).
5. Determine heat transfer from the heated find within a rectangular enclose containing air.
6. Determine how to solve a natural convection problem (in an infinitely long concentric cylinders).

7. Determine liquid enters through two inlets with different temperatures (multiphase flow) and leaves one outlet.

**Software can be used:** ANSYS, ALG Nastran, Star-CCM+, Fluent, FIRE. CFX.

| | |
|---|---|
| | **Course Outcomes :**<br>At the end of the course students will be able to |
| **CO1** | Acquire knowledge on structural analysis using analysis software packages. |
| **CO2** | Acquire knowledge on thermal analysis using analysis software packages. |
| **CO3** | Acquire knowledge on fluid flow analysis using analysis software packages. |
| **CO4** | Illustrate the utility of the software tools such as ANSYS, CFD etc; in solving real time problems |

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | | | 2 | | | 2 | 3 | | | 2 | 3 | |
| CO2 | 3 | 2 | | | 3 | | | | 2 | | | | | 3 | 2 |
| CO3 | | 2 | 3 | | 3 | 2 | | | | 3 | | | 2 | | 2 |
| CO4 | 3 | | 3 | | 3 | | | | 2 | | | | 2 | 3 | |
| CO5 | 3 | 2 | | | | 2 | | | 2 | 3 | | | 2 | | 2 |

**JNTUA COLLEGE OF ENGINEERING (Autonomous)-ANANTAPURAMU**
**Course Structure**
**DEPARTMENT OF MECHANICAL ENGINEERING**
**IV Year B.Tech. ME- II Semester**

| S.No | Subject Code | SUBJECT | L | P | CREDITS |
|---|---|---|---|---|---|
| 1 | 15A03801 | **Elective-II**<br>a) Production & Operations Management<br>b) Applied Solar Energy Engineering<br>c) Energy Ecology & Environment | 4 | 0 | 4 |
| 2 | 15A03802 | **Elective-III**<br>a) Power Plant Engineering<br>b) Design Of Material Handling Equipments<br>c) Advanced Metal Forming Technique | 4 | | 4 |
| 3 | 15A03803 | **Elective-IV**<br>a) Modern Manufacturing Methods<br>b) Jet Propulsion and Rocket Engineering<br>c) Mechanical vibrations | 4 | 0 | 4 |
| 4 | 15A03804 | **Elective-V**<br>a) Tribology<br>b) Computational Fluid Dynamics<br>c) Energy Management | 4 | 0 | 4 |
| 5 | 15A03805 | Seminar | 0 | 4 | 2 |
| 6 | 15A03806 | Project Work Part- B | 0 | 20 | 10 |
| | | Total | 16 | 24 | 28 |

**Note :** All End Examinations ( Theory and Practical ) are of Three Hours Duration. Machine Drawing End Examination is Four Hours Duration.
**T – Tutorial L – Theory P- Practical / Drawing C - Credits**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**

**MECHANICAL ENGINEERING**

**IV Year B.Tech.M.E. II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**PRODUCTION & OPERATIONS MANAGEMENT (15A03801)(a)**
**(Elective II)**

| **Course Objectives:** To impart knowledge on | |
|---|---|
| Co1 | To increase understanding of the problems and opportunities faced by the operations manager in manufacturing and service operations. |
| C4 06.2 | To develop an ability to apply operations management concepts in a variety of settings. |
| C4 06.3 | To develop an understanding of operations management techniques in order to be able to evaluate recommendations made by technical specialist in the field. |
| C4 06.4 | Identify operational methodologies to asses and improve the organizations performance |
| C4 06.5 | Utilize different inventory models for inventory management.Identify the modern trends in manufacturing and also understand how ERP and MRP-II systems are used in managing operations. |

**UNIT – I**

Functions of production planning & controls operations & productivity, productivity measurement, goods and services, 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 quantitive methods – accuracy of forecasting methods.

**UNIT – III**

Factors affecting facilities location, mathematical models for facilities, location, Types of facilities- layout: product layout, process layout, group technology layout, Assembly line balancing, computerised layout: ALDEP, CRAFT, CORELAP.

**UNIT – IV**

Strategies for aggregates planning, aggregate planning using O.R. Models, 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, LOB (Line of Balance).

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

| | **Course Outcomes:** |
|---|---|
| **CO1** | Understand and appreciation of principles, and applications related to planning, design and operations of manufacturing/service firm. |
| **CO2** | Identify different types of forecasting and different forecasting techniques, and use them for various firm forecast |
| **CO3** | Implement mathematical model for facilities, location, and utilize the computerized layouts and also able to distinguish between process layout, product layout |
| **CO4** | Identify operational methodologies to asses and improve the organizations performance |
| **CO5** | Utilize different inventory models for inventory management.Identify the modern trends in manufacturing and also understand how ERP and MRP-II systems are used in managing operations. |

**TEXT BOOKS :**

1. Modern Production / Operations Management by Baffa & Rakesh Sarin, Wiley, 1987
2. Operation Management by B. Mahadevan, Pearson Edu.
3. Operation Management by Adam & Ebert- PHI Pub.,

**REFERENCES :**

1. Operations Management – S.N. Chary.
2. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller.
3. Production Control A Quantitative Approach / John E. Biegel.
4. Production Control / Moore.
5. Operations Management / Joseph Monks.
6. Operation Management by Jay Heizar & Read new Pearson
7. Elements of Production Planning and Control / Samuel Eilon.

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | | 1 | | 1 | 2 | | 3 | | 1 | | 3 | |
| CO2 | | 3 | | 2 | | 1 | | 3 | 1 | | 1 | | 3 | | |
| CO3 | 3 | | | | 1 | | 1 | | | 2 | | 1 | | 3 | |
| CO4 | | 2 | 3 | 2 | | 1 | | 1 | | 1 | 1 | | 3 | | |
| CO5 | 3 | 1 | | | 1 | | 1 | | 1 | | | 1 | | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**

**MECHANICAL ENGINEERING**

**IV Year B.Tech.M.E. II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## APPLIED SOLAR ENERGY ENGINEERING (15A03801) (b)
**(Elective II)**

| | |
|---|---|
| | **Course Objectives:**<br>To impart knowledge on |
| **1** | The characteristics and world distribution of solar radiation |
| **2** | The solar radiation and measurement techniques |
| **3** | The methods of calculation of solar radiation availability at a given location. |
| | The fundamentals of thermal and direct conversion of solar energy to power. |

**UNIT – I**

SOLAR RADIATION: Sources of radiation –sun earth relationship, Solar Time and angles, day length, angle of incidence on tilted surface; Sun path diagram, Solar Radiation: Extraterrestrial Radiation; Effect of earth atmosphere; Estimation of solar radiation on horizontal and tilted surfaces. Geographic Distribution of solar radiation, Phyrellio, pyranometer, equation of timeestimation of average radiation falling on tilled.

**UNIT-II**

SOLAR ENERGY TECHNOLOGIES: Performance analysis of a liquid Flat-plate collector, Total loss coefficient and heat losses: Top loss coefficient, Bottom loss coefficient, Side loss coefficient. Solar concentrating collectors, types of concentrating collectors, Parabolic Dish System, The central power tower system, The Parabolic Trough System, Tracking CPC and Solar Swing, Performance analysis of cylindrical parabolic collector, Compound parabolic concentrator (CPC).

**UNIT-III**

SOLAR CELLS: Solar cell fundamentals, solar cell classification, solar cell, module, panel array construction, maximum power pint trackers(MPPT), solar PV applications, The Recent developments in Solar cells, Role of Nano-Technology in Solar cells.

**UNIT – IV**

ECONOMICS: Discounted Cash Flow-light cycle, coasting of solar system, production function and optimization

**UNIT – V**

THERMAL POWER: The power concepts- design aspects, thermo-chemical reactor. SOLAR POND AND SOLAR STILLS: Working Principle-Construction-operating difficulties and remedies, Agriculture and Domestic applications: Still, timber drying, crop drying, cooker.

| | **Course Outcomes:** |
|---|---|
| **CO1** | They can know the world and India energy resources and solar spectrum. |
| **CO2** | Students can able measure the solar radiation on earth surface and depletion of solar radiation. |
| **CO3** | Understand the geometry of solar radiation and its calculations. |
| **CO4** | They can able to know the principles thermodynamic cycles and conversion of solar thermal energy conversion. |
| **CO5** | Students can able to know the principles and conversion of solar electrical energy conversion. |

**Reference Books**:

1. Solar Energy Thermal Process Diffice and Beckman
2. Solar Heating and Cooling by Kreith and Kreider
3. Solar Energy Utilization by G.D.Rai
4. Solar Energy Utilization by G.D.Rai , Khanna Publishers.
5. Renewable Energy Sources and Emerging Technologies- By D.P. Kothari, PHI Pub.
6. Applied Solar Energy by Meinel and Meinel
7. Non-Conventional Energy Resources by B.H . Khan, Tata McGraw Hill
8. Energy Resources Utilization and Technologies By Anjaneyulu, BS Pub.,

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | 1 | | | 3 | | 1 | | 3 | 2 | 3 | 2 | 2 |
| CO2 | | | 2 | 1 | | | 3 | 2 | | 3 | | | | | 2 |
| CO3 | | 2 | | 1 | | | | 2 | 1 | | 3 | 2 | 3 | 2 | |
| CO4 | | | 2 | 1 | | | | | | 3 | | 2 | | | |
| CO5 | | 2 | | 1 | | | 3 | 2 | 1 | | 3 | | | 2 | 2 |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**

**MECHANICAL ENGINEERING**

**IV Year B.Tech.M.E. II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## ENERGY ECOLOGY & ENVIRONMENT (15A03801) (c)
## (Elective II)

| | **Course Objectives:** To impart knowledge on |
|---|---|
| 1 | To facilitate the understanding of ENERGY ECOLOGY. |
| 2 | Understand the concepts of Energy transactions in biosphere |

**UNIT-I**

Energy source for earth – sun – its radiation – its absorption and reflection. Various renewable and non-renewable resources.

**UNIT-II**

Boisphere – Energetic of the biosphere – Concepts of Ecology – Components of Ecosystems.

**UNIT-III**

Energy transactions in biosphere – photo synthesis and producers – Herbivones – Carnivones – decomposers – Energy transfers & food wells.

**UNIT-IV**

Dependence on abiotic systems – biogeochemical cycles. Elements of Environment – Interrelationships in environmental components.

**UNIT-V**

Concepts of pollution and affecting the natural balances in energy systems. Energy concepts for a sustainable world bio – systems.

| **Course Outcomes :** At the end of the course students will be able to | |
|---|---|
| **CO1** | Understand the Energy source from Nature |
| **CO2** | Understand the energy ecology & environment |

**REFERENCE BOOKS**:

1. Renewable Energy, Environment and Development, Maheshwar Dayal, Konark Publishers Pvt. Ltd.,
2. Ecology and Environment, P.D. Sharma Rastogi Publications.
3. Energy for a sustainable world, J.Goldenberg, T.B. Johnson, Amulya K.Reddy & Robert Williams Willey Eastern Ltd., Concepts of Ecology, E.J.Kormondal , Prentice Hall India

Ltd.,

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | | | | |
| CO4 | | | | | | | | | | | | | | | |
| CO5 | | | | | | | | | | | | | | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**

**MECHANICAL ENGINEERING**

| **IV Year B.Tech.M.E. II Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **1** | **0** | **4** |

**POWER PLANT ENGINEERING (15A03802-a)**
**(Elective-III)**

| | **Course Objectives:** |
|---|---|
| 1 | The primary objective of this course is to give the engineering student a basic understanding of Rankine cycle |
| 2 | Fundamental concepts of gas turbines with reheat and regeneration |
| 3 | To study power plants like steam, hydro, hydel, tidal and nuclear power plants |
| 4 | To know the power generation potential calculation |
| 5 | To familiarize the student with the operations to run various power plants |

**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 - Combined Power Cycles - Comparison and Selection, Power Plant Economics and Environmental Considerations: Capital Cost, Investment of Fixed Charges, Operating Costs, General Arrangement of Power Distribution, Load Curves, Load Duration Curve.

Definitions of Connected Load, Maximum Demand, Demand Factor, Average Load, Load Factor, Diversity Factor – Tariff - Related Exercises. Effluents from Power Plants and Impact on Environment – Pollutants and Pollution Standards – Methods of Pollution Control. Inspection And Safety Regulations.

**UNIT II**

Steam Power Plant : Modern High Pressure and Supercritical Boilers - Analysis of Power Plant Cycles - Modern Trends in Cycle Improvement - Waste Heat Recovery, Fluidized Bed Boilers., Fuel and Handling Equipments, Types of Coals, Coal Handling, Choice of Handling Equipment, Coal Storage, Ash Handling Systems.

Steam Power Plant : Combustion Process : 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, Design and Construction, Dust Collectors, Cooling Towers And Heat Rejection. Analysis of Pollution from Thermal Power Plants - Pollution Controls.$CO_2$ Recorders

**UNIT III**

Diesel Power Plant: Diesel Power Plant: Introduction – IC Engines, Types, Construction– Plant Layout with Auxiliaries – Fuel Storage

Gas Turbine Plant : Introduction – Classification - Construction – Layout With Auxiliaries – Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages 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 Plants.

**UNIT V**

Power from Non-Conventional Sources: Utilization of Solar Collectors- Principle Of its Working, Wind Energy – Types of Turbines – HAWT & VAWT-Tidal Energy. MHD power generation.

Nuclear Power Station: Nuclear Fuel – Nuclear Fission, Chain Reaction, Breeding and Fertile Materials – Nuclear Reactor –Reactor Operation.

Types of 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.

| | **Course Outcomes:** |
|---|---|
| CO1 | Analyze the efficiency and output of modern Rankin cycle steam power plants with superheat, reheat, regeneration, and irreversibilities. |
| CO2 | Calculate the performance of gas turbines with reheat and regeneration, and discuss the benefit of combined cycle power plants. |
| CO3 | Explain the major types of steam, hydro, nuclear, tidal power plants and |
| CO4 | Estimate power generation potential. |
| CO5 | Scope of employability in various power plants |

***Text Books:***

*1. Power plant Engineering, P.K. Nag, TMH, 3rd edition, 2013.*
*2. A course in power plant Engineering, Arora and S. Domkundwar.*

***Reference Books:***

*1. Power plant Engineering, Ramalingam, Scietech Publishers*
*2. Power plant engineering P.C. Sharma, S.K. Kataria Publications,2012.*
*3. A Text Book of Power Plant Engineering, Rajput , Laxmi Publications, 4th edition, 2012.*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 1 | | 1 | 1 | 1 | | 1 | | 1 | 2 | 2 | | |
| CO2 | 2 | | 3 | 3 | 1 | | | | 1 | 1 | 1 | | 3 | | 1 |
| CO3 | 2 | | 2 | | 1 | | 1 | | 1 | | | | | 2 | 1 |
| CO4 | 2 | 3 | | 2 | | | | | 1 | | | 2 | 1 | 2 | 1 |
| CO5 | 2 | 3 | | 1 | | | | | | | 1 | | | 2 | 1 |

**JNTUACEA** **R-15**

**2015-16**

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**

**MECHANICAL ENGINEERING**

| **IV Year B.Tech.M.E. II Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **1** | **0** | **4** |

## DESIGN OF MATERIAL HANDLING EQUIPMENTS (15A03802-b)
**(Elective – III)**

| | **Course Objectives: Students will be able to** |
|---|---|
| 1 | Understand about Material handling equipment |
| 2 | Understand how to design Hoists |
| 3 | Understand the types Conveyors |
| 4 | |

**UNIT I**
**MATERIALS HANDLING EQUIPMENT**
Types, selection and applications

**UNIT II**
**DESIGN OF HOISTS**
Design of hoisting elements: Welded and roller chains - Hemp and wire ropes - Design of ropes, pulleys, pulley systems, sprockets and drums, Load handling attachments. Design of forged hooks and eye hooks – crane grabs - lifting magnets - Grabbing attachments - Design of arresting gear - Brakes: shoe, band and cone types.

**UNIT III**
**DRIVES OF HOISTING GEAR**
Hand and power drives - Traveling gear - Rail traveling mechanism - cantilever and monorail cranes - slewing, jib and luffing gear - cogwheel drive - selecting the motor ratings.

**UNIT IV**
**CONVEYORS**
Types - description - design and applications of Belt conveyors, apron conveyors and escalators Pneumatic conveyors, Screw conveyors and vibratory conveyors.

**UNIT V**
**ELEVATORS**
Bucket elevators: design - loading and bucket arrangements - Cage elevators - shaft way, guides, counter weights, hoisting machine, safety devices - Design of fork lift trucks.

| | **Course Outcomes:** Students will be able to |
|---|---|
| CO1 | Understand various applications of Material handling equipment |

| | |
|---|---|
| CO2 | Get the knowledge about Hoisting gears |
| CO3 | Understand the types Conveyors |
| CO4 | Understand how to design Hoists |
| CO5 | Understand how to design Elevators |

**REFERENCES**

1. Rudenko, N., Materials handling equipment, ELnvee Publishers, 1970.

2. Spivakovsy, A.O. and Dyachkov, V.K., Conveying Machines, Volumes I and II, MIR Publishers, 1985.
3. Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.
4. Boltzharol, A., Materials Handling Handbook, The Ronald Press Company, 1958.
5. P.S.G. Tech., "Design Data Book", Kalaikathir Achchagam, Coimbatore, 2003.
6. Lingaiah. K. and Narayana Iyengar, "Machine Design Data Hand Book", Vol. 1 & 2, Suma Publishers, Bangalore, 1983

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | | | | |
| CO2 | 1 | | | | 2 | 2 | | 2 | | | | | 2 | | 2 |
| CO3 | | | 2 | | | | | | | 2 | | | | | |
| CO4 | | | | | | | | | | | | | 3 | | |
| CO5 | | | 2 | 2 | | 3 | | 3 | | | 3 | | | | 2 |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**

**MECHANICAL ENGINEERING**

| **IV Year B.Tech.M.E. II Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **1** | **0** | **4** |

**ADVANCED METAL FORMING TECHNIQUE (15A03802-c)**
**(Elective-III)**

| | **Course Objectives:** To impart knowledge on |
|---|---|
| **1** | The objective of this course is to teach metal forming theory and technology, limits of the processes, tool design and machinery selection |

**UNIT I**
**INTRODUCTION TO THEORY OF PLASTICITY AND FORMING**

Theory of plastic deformation – Yield criteria – Tresca and Von-mises – Distortion energy – Stress-strain relation – Mohr‟s circle representation of a state of stress – cylindrical and spherical co-ordinate system – upper and lower bound solution methods – thermo elastic Elasto plasticity – elasto visco plasticity

**UNIT II**
**THEORY AND PRACTICE OF BULK FORMING PROCESSES**

Analysis of plastic deformation in Forging, Rolling, Extrusion, rod/wire drawing and tube drawing – Effect of friction – calculation of forces, work done – Process parameters, equipment used – Defects – applications – Recent advances in Forging, Rolling, Extrusion and Drawing processes – Design consideration in forming - Formability of laminated sheet - Overview of FEM applications in Metal Forming analysis.

**UNIT III**
**SHEET METAL FORMING**

Formability studies – Conventional processes – H E R F techniques – Superplastic forming techniques – Hydro forming – Stretch forming – Water hammer forming – Principles and process parameters – Advantage, Limitations and application

**UNIT IV**
**POWDER METALLURGY AND SPECIAL FORMING PROCESSES**

Overview of P/M technique – Advantages – applications – Powder preform forging – powder rolling – Tooling, process parameters and applications. - Orbital forging – Isothermal forging – Hot and cold isostatic pressing – High speed extrusion – Rubber pad forming – Fine blanking – LASER beam forming

**UNIT V**

**ELECTROMAGNETIC FORMING AND ITS APPLICATIONS**

Electromagnetic Forming Process – Electro – Magnetic Forming Machines – Process Variables – Coils and Dies – Effect of Resistivity and Geometry – EM tube and sheet forming, stamping, shearing and welding – Applications – Finite Element Analysis of EM forming.

| | **Course Outcomes (COs):** At the end of the course students will be able to |
|---|---|
| **CO1** | Students understand the importance of the quality, costs of quality, and Basics concepts of quality |
| **CO2** | Able to know the TQM principles, employee involvement, team spirit and PDCA cycle. |
| **CO3** | They can able to understand the management tools like Six Sigma, Bench Marking. |
| **CO4** | Able to know TQM tools like control charts , QFD, Taguchi loss function and TPM. |
| **CO5** | The student would be able to apply the tools and techniques of quality management to manufacturing and services processes |

**REFERENCES**

1. Dieter G.E., Mechanical Metallurgy (Revised Edition II) McGraw Hill Co., 2004
2. Proceedings of International Workshop on EMFT 2010, Anna University
3. Altan T., Metal forming – Fundamentals and applications – American Society of Metals, Metals park, 2003.
4. ASM Hand book, Forming and Forging, Ninth edition, Vol – 14, 2003
5. SHIRO KOBAYASHI, SOO-IK-oh-ALTAN, T,Metal forming and Finite Element Method, Oxford University Press, 2001.
6. ALTAN.T, SOO-IK-oh, GEGEL, HL – Metal forming, fundamentals and Applications, American Society of Metals, Metals Park, Ohio, 1983.
7. Marciniak,Z., Duncan J.L., Hu S.J., „Mechanics of Sheet Metal Forming", Butterworth-Heinemann An Imprint of Elesevier, 2006
8. Proc. Of National Seminar on "Advances in Metal Forming" MIT, March 2000
9. SAE Transactions, Journal of Materials and Manufacturing Section 5, 1993-2007

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | 3 | | | | 1 | | | 3 | | 2 | | 1 |
| CO2 | 3 | | 2 | | 3 | | | | 2 | | | 2 | | 3 | |
| CO3 | | 3 | | | | | | | | 2 | | | | 3 | |
| CO4 | 3 | | 2 | | 3 | | | | 2 | | | 2 | | | |
| CO5 | | 1 | | 3 | | | | 1 | | 2 | 3 | | 2 | | 1 |

**JNTUACEA** **R-15**

**2015-16**

**IV Year B.Tech. M.E. -II Semester** **L T P C**

**3 1 0 4**

## MODERN MANUFACTURING METHODS (15A03803a)

**(ELECTIVE –IV)**

| | **Course Objectives:** To impart knowledge on |
|---|---|
| **1** | To understand the importance and have knowledge of Unconventional machining and forming processes. |
| **2** | To have the knowledge of different micro machining methods. |
| **3** | To understand the working principles of various Non-traditional methods in machining and forming. |

**UNIT I**

Need for Modern Manufacturing Methods: Non-traditional machining methods and rapid prototyping methods - their relevance for precision and lean manufacturing.
Classification of non-traditional processes - their selection for processing of different materials and the range of applications.
Introduction to rapid prototyping - Classification of rapid prototyping methods - sterolithography, fused deposition methods - materials, principle of prototyping and various applications.

**UNIT II**

Ultrasonic machining – Elements of the process, mechanics of material removal, process parameters, applications and limitations, Abrasive jet, Water jet and abrasive water jet machining: Basic mechanics of material removal, descriptive of equipment, process variables, applications and limitations.

**UNIT III**

Electro –Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, metal removal rate in ECM, Tooling, process variables, applications, economic aspects of ECM. Chemical Machining: Fundamentals of chemical machining- Principle of material removal- maskants
– etchants- process variables, advantages and applications.

**UNIT IV**

Thermal Metal Removal Processes: Basic principle of spark erosion (EDM), Wire cut EDM, and Electric Discharge Grinding processes - Mechanics of machining, process parameters, selection of tool electrode and dielectric fluids, choice of parameters for improved surface finish and machining accuracy - Applications of different processes and their limitations.
Plasma Machining: Principle of material removal, description of process and equipment, process variables, scope of applications and the process limitations.

**UNIT V**

Electron Beam Machining: Generation and control of electron beam for machining, theory of

electron beam machining, comparison of thermal and non-thermal processes - process mechanics, parameters, applications and limitations.

Laser Beam Machining: Process description, Mechanism of material removal, process parameters, capabilities and limitations, features of machining, applications and limitations.

| | |
|---|---|
| | **Course Outcomes :**At the end of the course students will be able to |
| **CO1** | Use the basic manufacturing methods, measurements and apply the principles of a range of modern manufacturing technologies, apply subtractive and additive manufacturing for rapid prototyping |
| **CO2** | Describe the specific process characteristics of various modern manufacturing technologies and identify their possible applications and metal removal rate |
| **CO3** | Students can able to know the fundamentals of electrochemical machining, its economical concepts and basics of chemical maching. |
| **CO4** | They can able to study the principles of EDM,EDG,PM ,its applications. |
| **CO5** | They can able to know the applications and limitations of Electron Beam machining and laser Beam Maching. |

***Text Books:***

*1. Advanced machining processes, VK Jain, Allied publishers.*

*2. Manufacturing processes for engineering materials by Serope Kalpakjian and Steven R Schmid, 5edn, Pearson Pub.*

***Reference Books:***

*1. New Technology , Bhattacharya A, The Institution of Engineers, India 1984*

*2. Manufacturing Technology, Kalpakzian,Pearson*

*3. Modern Machining Process , Pandey P.C. and Shah H.S., TMH.*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | 3 | | | 3 | | 1 | | | 1 | 1 | 3 | | |
| CO2 | | 2 | | | | | 2 | | 3 | 2 | | | | 1 | |
| CO3 | 1 | | | 2 | 1 | | | 1 | | | 3 | | 1 | | 2 |
| CO4 | | 2 | 3 | | | | 2 | | | 2 | | | | | 2 |
| CO5 | | | | 2 | | 3 | | | 3 | | | 1 | | 3 | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**

**MECHANICAL ENGINEERING**

| **IV Year B.Tech. M.E. II Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **1** | **0** | **4** |

**JET PROPULSION AND ROCKET ENGINEERING (15A03803b)**

**(Elective IV)**

| | **Course Objectives:** To impart knowledge on |
|---|---|
| **1** | .Understand the fundamentals of gas turbines |
| **2** | Understand the thermodynamics cycles |
| **3** | Know about Rocket technology |

**UNIT-I**

Fundamentals of Gas Turbine theory-Thermo dynamic Cycles, open closed and semi-closed – parameters of performances –cycle modifications for improvement of performance.

Jet propulsion: Historical sketch-reaction principle –essential features of propulsion devices-Thermal Engines, Classification of –Energy flow thrust, Thrust power and propulsion efficiency-Need for Thermal Jet Engines and applications

**UNIT-III**

Turboprop and Turbojet-1: Thermo dynamic cycles, plant layout, essential components, principles of operation –performance evaluation

Turboprop and Turbojet-II: Thrust Augmentation and Thrust reversal-Contrasting with piston Engine Propeller plant.

**UNIT-IV**

Ramjet: Thermo dynamic Cycle, plant lay-out, essential components –principle of operation-performance evaluation –comparison among atmospheric thermal jet engines- serqujet and pulse jet, elementary treatment.

Rocket Engines: Need for applications **–**Basic principles of operation and parameter s of performance –classification ,solid and liquid propellant rocket engines ,advantages, domains of application – propellants –comparison of propulsion systems.

**UNIT-V**

Rocket Technology-I: Flight mechanics, Application Thrust profiles, Acceleration –staging of Rockets ,need for –Feed systems, injectors and expansion nozzles –Rocket heat transfer and ablative cooling.

Rocket Technology- II: Testing & instrumentation –Need for Cryogenics –Advanced propulsion Systems, elementary treatment of Electrical Nuclear and plasma Arc propulsion.

| | **Course Outcomes :**<br><br>At the end of the course students will be able to |
|---|---|
| **CO1** | Understand the thermodynamics cycles |
| **CO2** | Understand the fundamentals of gas dynamic theory |
| **CO3** | Know about the rocket engines |
| **CO4** | Understand the Classification of rocket technology |
| **CO5** | Understand the applications of rocket engine |

**TEXT BOOKS:**

1. Gas Turbines and propulsive systems-P.Khajuria & S.P.Dubey / Dhanpat rai pub.
2. Gas Dynamics & Space Propulsion M.C.Ramaswamy / Jaico Publishing House.

**REFERENCE BOOKS:**

1. Rocket propulsion –Sutton
2. Gas Turbines /Cohen, Rogers & Sarvana Muttoo/Addision Wesley & Longman.
3. Gas Turbines-V.Ganesan /TMH.

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | | | | |
| CO2 | | 2 | | | | | | | | | 3 | | | | |
| CO3 | | | | | | | 3 | | 2 | | | | 2 | 3 | |
| CO4 | | | 1 | | 2 | | | | | | | | | | 3 |
| CO5 | 2 | | | | | | | 2 | | | | 2 | | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**
**MECHANICAL ENGINEERING**

**IV Year B.Tech.M.E. II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

## MECHANICAL VIBRATIONS (15A03803c)
**(Elective IV)**

| | **Course Objectives:** To impart knowledge on |
|---|---|
| **1** | Formulating mathematical model for vibration problems. |
| **2** | Skills in analyzing the vibration behavior of mechanical systems subjected to loading |
| **3** | Vibration control and the equipment used for collecting response data. |

**UNIT I**

Introduction: Importance and scope ,definitions and terminology, simple harmonic motion, combination of simple harmonic motions, Fourier analysis.

Single Degree Freedom Systems: Un-damped free vibration: Classical method, Energy method, equivalent systems, torsional systems. Damped free vibration- Viscous damping, under damping, critical damping, over damping. Coulomb damping, equivalent damping coefficient. Simple problems.

**UNIT II**

Forced vibrations of Single Degree Freedom Systems : Steady state forced vibration, sources of excitation, impressed harmonic force, resonance impressed force due to unbalance, motion excitation, transmissibility and isolation, performance of different type of isolators, power absorbed by viscous damping, General theory of seismic instruments, accelerometer and vibrometer, methods of vibration control- excitation reduction at source, system modification.

**UNIT III**

Two Degree Freedom Systems: Formulation of Equation of motion, Natural frequencies and modes of vibration by classical method, coupled pendulum Beat Phenomena, forced vibration, dynamic vibration absorber.

**UNIT IV**

Multi Degree Freedom Systems: Lagrangian method for formulation of equation of motion Influence coefficient method, Lumped mass and distributed mass systems, Stodola method, Holzer‟s method, Matrix iteration method, orthogonality of mode shapes, model analysis of free and forced vibrations.

**UNIT V**

Vibration of Continuous Systems: Longitudinal vibration of bars, torsional vibrations of circular rods or shafts, lateral vibrations of beams and shafts.

Whirling of Shafts: Critical speed of shafts, Rayleigh‟s upper bound approximation, Dunkerley‟s lower bound approximation, critical speed of shafts with damping.

| | |
|---|---|
| **Course Outcomes :**<br>At the end of the course students will be able to | |
| **CO1** | Familiar with basics of vibrations and able to formulate equations for free vibrations for SDOF with and without damping. |
| **CO2** | Familiar with the concepts of forced vibrations and the seismic instruments, accelerometers andvibrometers with the problems involved. |
| **CO3** | Able to formulate equations for 2DOF and evaluate the modes of vibration. |
| **CO4** | Able to frame and solve the equations for MDOF using various numerical iterative methods. |
| **CO5** | Familiar with the concepts of vibrations of continuous systems and whirling of shafts. |

***Text Books:***

*1. Elements of Vibrations Analysis L. Meirovich Tata McGraw Hill.*
*2. Vibration of Mechanical System, C. Nataraj, Cenage Learning, 1st edition, 2012.*

***Reference Books:***

*1. Mechanical Vibrations, S. Graham Kelly, Tata McGraw Hill.*
*2. Vibration Theory and Applications, William Thomson, Pearson Education, New Delhi*
*3. Vibration problems in Engineering, Timeoshenko and Young, John Wiley and sons Publishers,*
*4. Mechanical Vibrations, Singresu S. Rao, Pearson Education, New Delhi.*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 2 | | 2 | 1 | | | | 3 | 1 | 2 | 3 | | 3 |
| CO2 | | 3 | | 3 | | | | | 1 | | | | | 2 | |
| CO3 | | | 2 | | | 1 | | | | 2 | | 3 | | | 3 |
| CO4 | 3 | | | | 2 | | | | 1 | | 1 | 1 | 3 | 3 | |
| CO5 | | 3 | 2 | | | | | | | 1 | | | | 1 | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**
**MECHANICAL ENGINEERING**

| **IV Year B.Tech. M.E. II Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **1** | **0** | **4** |

# TRIBOLOGY
**(15A03804a)**

| | **Course Objectives:** To impart knowledge on |
|---|---|
| **1** | To introduce tribology as an important design consideration that affects the performance of engine and automotive elements. |
| **2** | To teach different bearing types, modeling and performance considerations. |
| **3** | To introduce concepts in friction and wear phenomena. |

**(Elective V)**

**UNIT I**

SURFACES AND FRICTION: Topography of Engineering surfaces- Contact between surfaces - Sources of sliding Friction - Adhesion Ploughint- Energy dissipation mechanisms Friction Characteristics of metals - Friction of non metals. Friction of lamellar solids - friction of Ceramic materials and polymers - Rolling Friction - Source of Rolling Friction - Stick slip motion – Measurement of Friction.

**UNIT II**

WEAR: Types of wear - Simple theory of Sliding Wear Mechanism of sliding wear of metals – Abrasive wear - Materials for Adhesive and Abrasive wear situations - Corrosive wear - Surface Fatigue wear situations - Brittle Fracture wear - Wear of Ceramics and Polymers - Wear Measurements.

**UNIT III**

LUBRICANTS AND LUBRICATION TYPES: Types, properties, Requirements of Lubricants – Testing methods - Hydrodynamic Lubrication - Elasto hydrodynamic lubrication- Boundary Lubrication, Mist lubrication, Requirements of lubrication, Solid Lubrication, Hydrostatic Lubrication.

**UNIT IV**

FILM LUBRICATION THEORY: Fluid film in simple shear - Viscous flow between very close parallel plates - Shear stress variation Reynolds Equation for film Lubrication - High speed unloaded journal bearings - Loaded journal bearings - Reaction torque on the bearings - Virtual Co-efficient of friction - The Somerfield diagram.

**UNIT V**

SURFACE ENGINEERING AND MATERIALS FOR BEARINGS: Surface modifications - Transformation Hardening, surface fusion - Thermo chemical processes - Surface coatings - Plating and anodizing - Fusion Processes - Vapour Phase processes - Materials for rolling Element bearings - Materials for fluid film bearings - Materials for marginally lubricated and dry bearings.

| | **Course Outcomes :**<br><br>At the end of the course students will be able to |
|---|---|
| **CO1** | Able to analyse the contact surface topography, surface parameters and calculate contact pressure, temperature and film thickness simulate wear. |
| **CO2** | Able to understand the types of friction and wear mechanisms and measure them. |
| **CO3** | Familiar with lubrication types, properties and use the suitable lubricant. |
| **CO4** | Able to solve problems on hydrodynamic and hydrostatic lubrication. |
| **CO5** | Familiar with bearing elements, materials, types and applications of triblogy. |

***Text Books:***

1. *I.M. Hutchings, Tribology, "Friction and Wear of Engineering Material ", Edward Arnold, London, 1992.*

***Reference Books:***

*1. T.A. Stolarski, " Tribology in Machine Design ", Industrial Press Inc., 1990.*

*2. Kenneth C Ludema, Friction, Wear, Lubrication: A textbook in Tribology, CRC Press,1996.*

*3. A.Cameron, " Basic Lubrication theory ", Longman, U.K.., 1981.*

*4. M.J.Neale (Editor), " Tribology Handbook ", Newnes. Butter worth, Heinemann, U.K., 1975.*

*5. B.C. Majumdar "Introduction to Tribology bearings", S. Chand*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 3 | 1 | 3 | 1 | | | 2 | | 2 | 2 | 1 | 3 |
| CO2 | | 2 | | 3 | 2 | | 3 | | 2 | | 3 | | | | |
| CO3 | | | | | | | | 1 | | 2 | | 2 | | | |
| CO4 | 3 | | 2 | | 3 | 1 | | | 2 | | 3 | | 2 | 1 | 3 |
| CO5 | | 2 | | 3 | | 2 | 2 | 1 | | | | | 2 | | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS): ANANTAPUR**
**MECHANICAL ENGINEERING**

**IV Year B.Tech. M.E. -II Semester**

| L | T | P | C |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

# COMPUTATIONAL FLUID DYNAMICS
## (15A03804b) (ELECTIVE - V)

| | **Course Objectives:** |
|---|---|
| 1. | The course will equip the students with the necessary knowledge to use computational techniques to solve problems related to flow mechanics. In particular, students will have hands-on experience in using computational fluid dynamics to solve engineering problems. |

**UNIT I**

Introduction: Methods to solve a physical problem , numerical methods , brief comparison between FDM, FEM & FVM, applied numerical methods. Solution of a system of simultaneous linear algebraic equations, Iterative schemes of matrix inversion, direct methods for matrix inversion, direct methods for baned matrices. Finite difference applications in heat conduction and convention, heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer.

**UNIT II**

Finite Differences: Discretization, consistency, stability, and fundamentals of fluid flow modelling, Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

**UNIT III**

Errors And Stability Analysis: introduction, first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modelling, conservative property, the upwind scheme.

Review Of Equations Governing Fluid Flow And Heat Transfer: Introduction, Conservation of mass Newton‟s second law of motion, expanded forms of Navier-stokes equations, conservation of energy principle, special forms of the Navier stokes equations.

**UNIT IV**

Steady Flow: Dimensions form of Momentum and Energy equations, Navier-Stokes equation, and conservative body force fields, stream function, vorticity formulation, boundary, layer theory, buoyancy, driven convection and stability.

**UNIT V**

Simple CFD Techniques: Viscous flows conservation form space marching, relocation techniques, viscous flows, conservation from space marching relocation techniques, artificial viscosity, the alternating direction implicit techniques, pressure correction technique, computer graphic techniques used in CFD. Quasi one dimensional flow through a nozzle, turbulence models, standard and high Reynolds number models and their applications.

| | |
|---|---|
| **Course Outcomes :** At the end of this course, the student will be able to: | |
| CO1 | Provide the student with a significant level of experience in the application of knowledge in mathematics and numerical methods to solve heat transfer problems using FDM |
| CO2 | To equip the student demonstrate the ability to use FDM to solve fundamental fluid flow problems and to know implement aspects of Finite Difference Equations. |
| CO3 | To equip the student demonstrate an ability to perform error and stability analysis in CFD and to revisit governing equations of fluid and heat transfer |
| CO4 | To equip the student demonstrate the ability to use appropriate model equations to investigate fluid flow in steady flow cases. |
| CO5 | To equip the student demonstrate the ability to describe viscous and turbulent flows to the application of CFD techniques. |

***Text Books:***

*1. Computational Fluid Dynamics, J Chung (2010), 2nd edition, Cambridge Uni Press,India.*
*2. Computational Fluid Dynamics, John .D. Anderson (2010), 3rd edition, McGraw- Hill International Edition, India.*

***Reference Books:***

*1. Computational Fluid Dynamics for Engineers, Ronnie Anderson (2012), 2nd edition, Cambridge University Press, India.*
*2. Computational aerodynamics and fluid dynamics an introduction, Jean-Jacques Chattot (2010),3rd edition, Springer, Germany.*
*3. Essential computational fluid Dynamics – olegzikanov, wiley India.*
*4. Introduction to computational fluid dynamics – pradip, Niyogi S.K. Chakrabary, M.K. Laha – Pearson.*

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 2 | | 2 | | | 2 | | 2 | | | 3 | 2 | |
| CO2 | | 3 | | 3 | | 3 | | | | | | | | | |
| CO3 | 3 | 3 | 2 | | 3 | | | | | 2 | | | 3 | 2 | |
| CO4 | 3 | | 2 | 1 | | 3 | | | | 2 | | | 3 | | |
| CO5 | | 3 | 2 | | 1 | 3 | | 2 | | 2 | | | | 2 | |

**JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS)::ANANTAPURAMU**
**MECHANICAL ENGINEERING DEPARTMENT**

| **IV Year B.Tech.M.E. II Semester** | **L** | **T** | **P** | **C** |
|---|---|---|---|---|
| | **3** | **1** | **0** | **4** |

**ENERGY MANAGEMENT (15A03804c)**
**(Elective – V)**

| | **Course Objectives:**<br>To impart knowledge on |
|---|---|
| **CO1** | Energy auditing in engineering and process industry |
| **CO2** | Energy conservation. |

**UNIT - I**
**ENGINEERING ECONOMICS**:
Managerial objectives - steps in planning- Capital budgeting- Classification of costs- Interest- Types- Nominal and effective interest rates Discrete and continuous compounding - discounting - Time value of money - Cash flow diagrams - Present worth factor, Capital recovery factor, Equal annual payments - Equivalence between cash flows.

**UNIT - II**
**DEPRECIATION & COST ANALYSIS**:
Aims-Physical depreciation-Functional depreciation- Methods of depreciation-Straight line method, Declining balance method, Sum of years digits method, Sinking fund method, Service output method- Capital recovery with return-Service life estimation- Morality curves. Break even analysis and break even chart- Minimum cost analysis- Benefit cost analysis- Life cycle cost analysis.

**UNIT - III**
**PROJECT MANAGEMENT:**
Methods of investment appraisal- Rate of return method, Payback period method, Net present value method (NPV)- Internal Rate of Return method(IRR)- Adoption of the methods in energy conservation campaign- Types of projects- Purpose of project management - Classification – Role and qualities of project manager - Types of budgets - Budget committee – budgeting.
Energy Management Programs:
Necessary steps of energy management programmer - Concepts of Energy management - General principles of energy management – Energy management in manufacturing and process industries- Qualities and functions of Energy manager - Language of Energy manager-Checklist for top management.

**UNIT - IV**
**ENERGY AUDITING:**

Definition- Objectives- Level of responsibility- Control of Energy- Uses of Energy checklists - Energy conservation- Energy index - Cost index - Pie charts-sankey diagrams Load profiles - Types of energy audits- Questionnaire - Energy audit of industries - General energy audit- Detailed energy audit - Energy saving potential.

**UNIT - V**

**ENERGY POLICY, SUPPLY, TRADE& PRICES:**

Energy resources in India – level of power generation – transmission & distribution of power. Indian energy policy,Energy trade & its economic impacts – domestic energy production – Energy transformation & distribution & energy self sufficiency. International & National crude oil prices – domestic fuel prices – natural gas, LPG, kerosene and firewood - pricing policy.

| | **Course Outcomes (COs):** Ability to |
|---|---|
| **CO1** | Objectives of management, different costs, money value |
| **CO2** | Evaluate the depreciation and cost analysis. |
| **CO3** | Apply the principles energy management for conservation. |
| **CO4** | Describe the energy rate structures. |
| **CO5** | Discussion of energy policies, prices and its trading |

**Text Books:**

1. Albert Thumann, Handbook of Energy Audits, The Fairmont Press Inc., Atlanta gergia, 1979.
2. Murphy W.R and Mckay G, Energy Management, Butterworths, London, 1982.
3. Albert Thumann, Plant Engineer and Management guide to Energy Conservation, Van Nost and Reinhold Co., Newyork.

**Reference Books:**

1. Energy Audits, E.E.O.-Book-lets, U.K. 1988.
2. Craig B.Smith, “Energy Management Principles”, Pergamon Press.
3. The role of Energy Manager, E.E.O., U.K.
4. The Energy conservation Design Resource Hand Book-The Royal architectural Institute of Canada.
5. Energy Management Hand Book-Ed. By Wayne C. Turner, John Wiley and sons, 1982.

**Mapping between Course Outcomes and Programme Outcomes**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | 1 | | | | 2 | | | | | | | 2 | |
| CO2 | 2 | | 1 | | 3 | | 2 | | 3 | | 3 | | | 2 | |
| CO3 | | 3 | | 2 | | 1 | | 1 | | 2 | | 2 | 1 | | 3 |
| CO4 | 2 | | | | | | | 1 | | | | | 1 | 2 | |
| CO5 | | | | 2 | | 1 | | | | 2 | | | | | 3 |

**Program Educational Objectives (PEOs)**

| | |
|---|---|
| **PEO 1** | **SUCCESSFUL CAREER**: Graduates of the program will have successful technical or professional career. |
| **PEO 2** | **LIFELONG LEARNING:** Graduates of the program will continue to learn and to adopt in a world of constantly evolving technology |
| **PEO 3** | **SERVICE TO SOCIETY:** Graduates of the program will have the capability to work with multi - disciplinary teams to implement innovative ideas ethically for uplifting the society. |