



**SIDDARTHA INSTITUTE OF SCIENCE AND TECHNOLOGY::PUTTUR  
(AUTONOMOUS)  
DEPARTMENT OF MECHANICAL ENGINEERING  
B.TECH (MECHANICAL ENGINEERING)  
R19 CURRICULUM**

| INDUCTION PROGRAM<br>(MANDATORY)                                                   | 3 WEEKS DURATION                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Induction program for students to be offered right at the start of the first year. | <ul style="list-style-type: none"> <li>• Physical activity</li> <li>• Creative Arts</li> <li>• Universal Human Values</li> <li>• Literary</li> <li>• Proficiency Modules</li> <li>• Lectures by Eminent People</li> <li>• Visits to local Areas</li> <li>• Familiarization to Dept./Branch &amp; Innovations</li> </ul> |

**I B. Tech. – I Semester**

| S. No                  | Course Code | Name of the Subject       | L             | T | P/Drg | C   |
|------------------------|-------------|---------------------------|---------------|---|-------|-----|
| 1.                     | 19HS0810    | Communicative English     | 3             | - | -     | 3   |
| 2.                     | 19HS0830    | Algebra & Calculus        | 3             | - | -     | 3   |
| 3.                     | 19HS0850    | Advanced Physics          | 3             | 1 | -     | 4   |
| 4.                     | 19CE0101    | Engineering Mechanics     | 2             | 1 | -     | 3   |
| 5.                     | 19HS0811    | Communicative English Lab | -             | - | 3     | 1.5 |
| 6.                     | 19HS0854    | Advanced Physics Lab      | -             | - | 3     | 1.5 |
| 7.                     | 19ME0301    | Workshop Practice Lab     | -             | - | 4     | 2.0 |
| Contact Periods / Week |             |                           | 11            | 2 | 10    | 18  |
|                        |             |                           | Total/Week 23 |   |       |     |

**I B. Tech. – II Semester**

| S. No                  | Course Code | Name of the Subject                        | L             | T | P/Drg | C   |
|------------------------|-------------|--------------------------------------------|---------------|---|-------|-----|
| 1.                     | 19HS0831    | Differential Equations and Vector Calculus | 3             | 1 | -     | 4   |
| 2.                     | 19HS0802    | Engineering Chemistry                      | 3             | 1 | -     | 4   |
| 3.                     | 19CS0501    | Python Programming                         | 3             | - | -     | 3   |
| 4.                     | 19ME0302    | Engineering Graphics                       | 1             | - | 4     | 3   |
| 5.                     | 19ME0303    | Materials Engineering                      | 3             | - | -     | 3   |
| 6.                     | 19HS0806    | Engineering Chemistry Lab                  | -             | - | 3     | 1.5 |
| 7.                     | 19CS0502    | Python Programming Lab                     | -             | - | 3     | 1.5 |
| Non -Credit Courses    |             |                                            |               |   |       |     |
| 8.                     | 19HS0816    | Indian Constitution                        | 3             | - | -     | -   |
| Contact Periods / Week |             |                                            | 16            | 2 | 10    | 20  |
|                        |             |                                            | Total/Week 28 |   |       |     |

**II B. Tech. – I Semester**

| S. No                  | Course Code | Name of the Subject                              | L             | T | P/Drg | C   |
|------------------------|-------------|--------------------------------------------------|---------------|---|-------|-----|
| 1.                     | 19EE0240    | Basic Electrical and Electronics Engineering     | 3             | - | -     | 3   |
| 2.                     | 19CE0150    | Strength of Materials                            | 3             | 1 | -     | 4   |
| 3.                     | 19CE0151    | Fluid Mechanics & Hydraulics Machinery           | 2             | 1 | -     | 3   |
| 4.                     | 19ME0304    | Kinematics of Machinery                          | 2             | 1 | -     | 3   |
| Open Elective-1        |             |                                                  |               |   |       |     |
| 5.                     | 19CE0136    | Water Technology                                 | 3             | - | -     | 3   |
|                        | 19EE0238    | Generation of Energy through Waste               |               |   |       |     |
|                        | 19EC0448    | Introduction to Communication Systems            |               |   |       |     |
|                        | 19CS0550    | Relational Database Management System            |               |   |       |     |
|                        | 19HS0813    | Management Science                               |               |   |       |     |
| 6.                     | 19EE0241    | Basic Electrical and Electronics Engineering Lab | -             | - | 2     | 1.0 |
| 7.                     | 19CE0106    | Strength of Materials Lab                        | -             | - | 3     | 1.5 |
| 8.                     | 19CE0112    | Fluid Mechanics& Hydraulics Machinery Lab        | -             | - | 3     | 1.5 |
| Non -Credit Course     |             |                                                  |               |   |       |     |
| 9.                     | 19HS0805    | Environmental Science                            | 3             | - | -     | -   |
| Contact Periods / Week |             |                                                  | 16            | 3 | 8     | 20  |
|                        |             |                                                  | Total/Week 27 |   |       |     |

**II B. Tech. – II Semester**

| S. No                  | Course Code | Name of the Subject                         | L             | T | P/Drg | C   |
|------------------------|-------------|---------------------------------------------|---------------|---|-------|-----|
| 1.                     | 19HS0833    | Numerical Methods, Probability & Statistics | 4             | - | -     | 4   |
| 2.                     | 19ME0305    | Engineering Thermodynamics                  | 2             | 1 | -     | 3   |
| 3.                     | 19ME0306    | Manufacturing Processes                     | 3             | - | -     | 3   |
| 4.                     | 19ME0307    | Theory of Machines                          | 2             | 1 | -     | 3   |
| Open Elective-II       |             |                                             |               |   |       |     |
| 5.                     | 19CE0143    | Fundamentals of Urban Planning              | 3             | - | -     | 3   |
| 6.                     | 19EE0233    | Industrial Instrumentation                  |               |   |       |     |
| 7.                     | 19EC0451    | Elements of Embedded Systems                |               |   |       |     |
| 8.                     | 19CS0551    | Java Programming                            |               |   |       |     |
| 9.                     | 19HS0814    | Intellectual Property Rights                |               |   |       |     |
| 10.                    | 19ME0308    | Fuels Lab                                   | -             | - | 3     | 1.5 |
| 11.                    | 19ME0309    | Manufacturing Processes Lab                 | -             | - | 3     | 1.5 |
| 12.                    | 19ME0310    | Computer Aided Machine Drawing Lab          | -             | - | 2     | 1.0 |
| Non -Credit Course     |             |                                             |               |   |       |     |
| 13.                    | 19HS0817    | Essence of Indian Traditional Knowledge     | 3             | - | -     | -   |
| Contact Periods / Week |             |                                             | 17            | 2 | 8     | 20  |
|                        |             |                                             | Total/Week 27 |   |       |     |

**III B.Tech– I Semester**

| S.No                   | Course Code | Name of the Subject                             | L             | T | P/Drg | C   |
|------------------------|-------------|-------------------------------------------------|---------------|---|-------|-----|
| 1.                     | 19ME0311    | Design of Machine Elements-I                    | 3             | 1 | -     | 4   |
| 2.                     | 19ME0312    | Machine Tools                                   | 3             | - | -     | 3   |
| 3.                     | 19ME0313    | CAD/CAM                                         | 3             | - | -     | 3   |
| 4.                     | 19ME0314    | Thermal Engineering                             | 3             | - | -     | 3   |
| Open Elective-III      |             |                                                 |               |   |       |     |
| 5.                     | 19CE0129    | Elements of Road Traffic Safety                 | 3             | - | -     | 3   |
|                        | 19EE0239    | Solar Photovoltaic Systems                      |               |   |       |     |
|                        | 19EC0450    | Introduction to IOT                             |               |   |       |     |
|                        | 19CS0545    | Software Development & Testing                  |               |   |       |     |
|                        | 19HS0861    | Business Ethics                                 |               |   |       |     |
| 6.                     | 19ME0315    | Machine Tools lab                               | -             | - | 3     | 1.5 |
| 7.                     | 19ME0316    | Thermal Engineering- Lab                        | -             | - | 3     | 1.5 |
| 8.                     | 19ME0317    | Computer Aided Modeling & Analysis Lab          | -             | - | 2     | 1.0 |
| Non -Credit Course     |             |                                                 |               |   |       |     |
| 9.                     | 19HS0859    | English for Corporate Communications Skills Lab | 3             | - | -     | -   |
| Contact Periods / Week |             |                                                 | 18            | 1 | 8     | 20  |
|                        |             |                                                 | Total/Week 27 |   |       |     |

**III B. Tech – II Semester**

| S.No                   | Course Code        | Name of the Subject                | L             | T | P/Drg | C   |
|------------------------|--------------------|------------------------------------|---------------|---|-------|-----|
| 1.                     | 19ME0318           | Design of Machine Elements-II      | 3             | 1 | -     | 4   |
| 2.                     | 19ME0319           | Heat & Mass Transfer               | 3             | - | -     | 3   |
| 3.                     | 19ME0320           | Metrology & Measurements           | 3             | - | -     | 3   |
| 4.                     | 19ME0321           | Non-Conventional Energy Resources  | 3             | - | -     | 3   |
|                        | Open Elective-IV   |                                    |               |   |       |     |
| 5.                     | 19CE0147           | Project Planning and Control       | 3             | - | -     | 3   |
|                        | 19EE0231           | Neural Networks and Fuzzy Logic    |               |   |       |     |
|                        | 19EC0451           | MATLAB Programming                 |               |   |       |     |
|                        | 19CS0546           | Introduction to Cyber Security     |               |   |       |     |
|                        | 19HS0862           | Strategic Management               |               |   |       |     |
| 6.                     | 19ME0322           | Heat Transfer Lab                  | -             | - | 3     | 1.5 |
| 7.                     | 19ME0323           | Metrology and Measurements Lab     | -             | - | 3     | 1.5 |
| 8.                     | 19ME0324           | Robot Programming Lab              | -             | - | 2     | 1.0 |
|                        | Non -Credit Course |                                    |               |   |       |     |
| 9.                     | 19HS0858           | Human Values & Professional Ethics | 3             | - | -     | -   |
| Contact Periods / Week |                    |                                    | 18            | 1 | 8     | 20  |
|                        |                    |                                    | Total/Week 27 |   |       |     |

## IV B.Tech – I Semester

| S.No                   | Course Code                             | Name of the Subject                       | L             | T | P/Drg | C  |
|------------------------|-----------------------------------------|-------------------------------------------|---------------|---|-------|----|
| 1.                     | 19ME0325                                | Operation Research                        | 3             | - | -     | 3  |
| 2.                     | 19ME0326                                | Modern Machining Methods                  | 3             | - | -     | 3  |
| 3.                     | 19ME0327                                | Automobile Engineering                    | 3             | - | -     | 3  |
| 4.                     | Professional Elective Course (PEC) –I   |                                           | 3             | - | -     | 3  |
|                        | 19ME0333                                | Gas Dynamics and Jet Propulsion           |               |   |       |    |
|                        | 19ME0334                                | Power Plant Engineering                   |               |   |       |    |
|                        | 19ME0335                                | Refrigeration & Air Conditioning          |               |   |       |    |
| 5.                     | Professional Elective Course (PEC) –II  |                                           | 3             | - | -     | 3  |
|                        | 19ME0336                                | Finite Element Analysis                   |               |   |       |    |
|                        | 19ME0337                                | Mechatronics & Robotics                   |               |   |       |    |
|                        | 19ME0338                                | Quality Control & Reliability Engineering |               |   |       |    |
| 6.                     | Professional Elective Course (PEC) –III |                                           | 3             | - | -     | 3  |
|                        | 19ME0339                                | Industrial Engineering &Management        |               |   |       |    |
|                        | 19ME0340                                | Advanced Welding processes                |               |   |       |    |
|                        | 19ME0341                                | Computer Aided Process Planning           |               |   |       |    |
| 7.                     | 19ME0328                                | Internship (60 hours)                     | -             | - | -     | 3  |
| 8.                     | 19ME0329                                | Project Phase-I                           | -             | - | 4     | 2  |
| Contact Periods / Week |                                         |                                           | 18            | - | 4     | 23 |
|                        |                                         |                                           | Total/Week 22 |   |       |    |

## IV B.Tech – II Semester

| S.No                   | Course Code | Name of the Subject     | L             | T | P/Drg | C  |
|------------------------|-------------|-------------------------|---------------|---|-------|----|
| 1.                     |             | MOOC                    | -             | - | -     | 3  |
| 2.                     | 19ME0330    | Seminar                 | -             | - | 6     | 3  |
| 3.                     | 19ME0331    | Comprehensive Viva Voce | -             | - | -     | 2  |
| 4.                     | 19ME0332    | Project Phase-II        | -             | - | 22    | 11 |
| Contact Periods / Week |             |                         | -             | - | 28    | 19 |
|                        |             |                         | Total/Week 28 |   |       |    |

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

| Year     | 1 <sup>st</sup> year |        | 2 <sup>nd</sup> year |        | 3 <sup>rd</sup> year |        | 4 <sup>th</sup> year |        | Total |
|----------|----------------------|--------|----------------------|--------|----------------------|--------|----------------------|--------|-------|
| Semester | I sem                | II sem | I sem                | II sem | I sem                | II sem | I sem                | II sem |       |
| Credits  | 18                   | 20     | 20                   | 20     | 20                   | 20     | 23                   | 19     | 160   |

**Note:** Total Number of credits = 160

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**I B.Tech- I Sem**

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| <b>L</b> | <b>T</b> | <b>P</b> | <b>C</b> |
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**(19HS0810) COMMUNICATIVE ENGLISH**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Facilitate effective listening skills for better comprehension of academic lectures and english spoken by native speakers.*
2. *Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials.*
3. *Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations.*
4. *Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information.*
5. *Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing.*

**COURSE OUTCOMES**

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

1. *Understand social or transactional dialogues spoken by native speakers of English and Identify the context, topic, and pieces of specific information.*
2. *Employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information.*
3. *Participate in informal discussions and speak clearly on a specific topic or in general.*
4. *Comprehend, discuss and respond to academic texts and use appropriate language for description and interpretation in writing*
5. *Form sentences using proper grammatical structures and correct word forms.*

**UNIT – I**

**Part-1**

**Listening:** Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.

**Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

**Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information.

**Writing:** Beginnings and endings of paragraphs - introducing the topic, Letter writing.

**Grammar and Vocabulary:** Parts of speech; singular and plural; Basic sentence structures; simple question form - wh-questions; word order in sentences and Content words

**Part-2**

Half a Rupee Worth by R K Narayan from Engage with English.

**UNIT – II**

**Part-1**

**Listening:** Answering a series of questions about main idea and supporting ideas after listening to audio texts.

**Speaking:** Discussion in pairs/ small groups on specific topics followed by short structured talks.

**Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

**Writing:** Mechanics of writing – punctuations

**Grammar and Vocabulary:** Cohesive devices - linkers, sign posts and transition signals; use of articles and zero article; prepositions and function words

**Part-2**

The Thakur's Well by Premchand from Paths to Skills in English.

**UNIT – III**

**Part-1**

**Listening:** Listening for global comprehension and summarizing what is listened to.

**Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed

**Reading:** Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.

**Writing:** Summarizing Report Writing.

**Grammar and Vocabulary:** Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes and word forms

**Part-2**

I am not that Woman by Kishwar Naheed from Engage with English.

**UNIT – IV**

**Part-1**

**Listening:** Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

**Speaking:** conversational English in academic contexts (formal and informal).

**Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

**Writing:** Information transfer

**Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of synonyms and antonyms.

**Part-2**

What is my name? By Sathyavathi from Paths to Skills in English.

**UNIT – V**

**Part-1**

**Listening:** Identifying key terms.

**Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides. **Reading:** Reading for comprehension.

**Writing:** Writing structured essays on specific topics using suitable claims and evidences.

**Grammar and Vocabulary:** Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement).

**Part-2**

The Power of Prayer by A P J Abdul Kalam from Paths to Skills in English.

**TEXT BOOKS**

1. Prof. G.M. Sundaravalli & A.S.Kamalakar, *Paths to Skills in English*, Orient Blackswan, First Edition, 2015.
2. Board of Editors *Engage with English*, Orient Blackswan, First Edition, 2016

**REFERENCES**

1. Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.
2. Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking*, Heinley ELT, 2nd Edition, 2018.
3. Hewings, Martin. *Cambridge Academic English (B2)*.CUP, 2012.
4. Eric H.Glending & Beverly Holmström Study Reading: A Course in Reading Skills for Academic Purposes Cambridge University Press; 2 edition, 14 October 2004.

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**I B.Tech – I Sem**

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**(19HS0830) ALGEBRA AND CALCULUS**

**COURSE OBJECTIVES**

The objectives of this course is to

- 1. This course will illuminate the students in the concepts of calculus and linear algebra.*
- 2. Equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.*
- 3. Evaluate multiple integrals in Cartesian, cylindrical and spherical geometries*

**COURSE OUTCOMES**

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

- 1. Develop the use of matrix algebra techniques that is needed by engineers for Practical applications*
- 2. Utilize mean value theorems to real life problems*
- 3. Familiarize with functions of several variables which is useful in optimization*
- 4. Learn important tools of calculus in higher dimensions. Students will become familiar with 2-dimensional coordinate systems*
- 5. Become familiar with 3- dimensional coordinate systems and also learn the utilization of special functions.*

**UNIT – I**

**Matrices:** Rank of a matrix by echelon form - Solutions of system of homogeneous and non-homogeneous linear equations - Eigen values and Eigen vectors and their properties -Cayley-Hamilton theorem (without proof), Finding inverse and power of a matrix by Cayley-Hamilton theorem - Diagonalization of a matrix - Quadratic forms and nature of the quadratic forms, Reduction of quadratic form to canonical form by orthogonal transformation.

**UNIT – II**

**Calculus and Mean Value Theorems:** Rolle's Theorem - Lagrange's mean value theorem - Cauchy's mean value theorem - Taylor's and Maclaurin's theorems (without proofs).

**UNIT – III**

**Multivariable Calculus:** Partial derivatives - Total derivatives - Chain rule - Jacobians - Functional dependence - Maxima and minima of functions of two variables - Method of Lagrange multipliers.

**UNIT – IV**

**Integral Calculus:** Evaluation of definite and improper integrals (single variable)

**Multiple Integration:** Double integrals (Cartesian) - Change of order of integration in double integrals - Change of variables (Cartesian to polar) - Evaluation of Triple integrals (Cartesian).

**UNIT – V**

**Special Functions:** Beta and Gamma functions and their properties - Relation between Beta and Gamma functions - Evaluation of definite integrals using Beta and Gamma functions.

**TEXT BOOKS**

1. B. S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 42<sup>nd</sup> Edition, 2017
2. B. V. Ramana, *Higher Engineering Mathematics*”, Tata McGraw Hill Companies, Third Edition

**REFERENCES**

1. T.K.V. Iyengar, *Engineering Mathematics Volume-I*, S.Chand Publication, 5<sup>th</sup> Edition, 2010
2. T.K.V. Iyengar, *Engineering Mathematics Volume-II*, S.Chand Publication, 5<sup>th</sup> Revised Edition, 2011
3. T.K.V. Iyengar, *Engineering Mathematics Volume-III*, S.Chand Publication, 10<sup>th</sup> Revised Edition, 2015
4. E.Rukmangadachari, *Engineering mathematics, volume-I*, Pearson Publishers, 1<sup>st</sup> Edition, 2015
5. Dr.C. Sankaraiah, *Mathematical Methods*, Unitech series, First Edition, 2008



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**I B.Tech – I Sem**

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**(19HS0850)ADVANCED PHYSICS**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Recognize the various basic terms related to Oscillations.*
2. *Familiarize the basic concepts of acoustics and ultrasonic with their Engineering applications.*
3. *Understand the phenomenon of the interference and diffraction.*
4. *Impart knowledge in basic concepts of optical fibers and Laser's along with its Engineering applications.*
5. *Understand the fundamentals of Nano Science & Technology.*

**COURSE OUTCOMES**

On Completion of the course, the students will be able to

1. *Analyze the differences between interference and diffraction with applications.*
2. *Apply the principles of acoustics in designing of buildings.*
3. *Explains the applications of ultrasonic sin various engineering fields.*
4. *Explain the applications of dielectric and magnetic materials.*
5. *Apply concepts of Lasers and Optical Fibers light in various applications.*
6. *Apply the basic properties of nanomaterials in various engineering branches.*

**UNIT –I**

**Wave Optics**

**Interference:** Principle of Superposition-Interference of light-Conditions for sustained Interference - Interference in thin films (reflected light)-Newton's Rings-Determination of Wavelength.

**Diffraction:** Fraunhofer Diffraction-Single Slit - Diffraction Grating – Grating Spectrum - Determination of Wavelength of Light.

**UNIT – II**

**Acoustics and Ultra Sonics**

**Acoustics:** Introduction – Reverberation – Reverberation time – Sabine's formula- Derivation of Sabine's formula, Absorption coefficient and its determination –factors affecting acoustics of buildings and their remedies.

**Ultra Sonics:** Introduction, Properties and Production by piezoelectric method – Detection methods – Applications of ultrasonics.

**UNIT – III**

**Magnetic Materials and Dielectric Materials**

**Magnetic Materials:** Introduction-Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability- Origin of magnetic moment -Classification of Magnetic materials- -Hysteresis-soft and hard magnetic materials.

**Dielectric Materials:** Introduction--Dielectric polarization-Dielectric polarizability, Susceptibility and Dielectric constant- Types of polarizations: Electronic and Ionic, Orientation Polarizations (Qualitative) - Frequency dependence of polarization-Lorentz (internal) field-Claussius - Mosotti equation-Applications of Dielectrics

**UNIT – IV****Lasers and Fiber Optics**

**Lasers:** Introduction - Characteristics of Laser - Spontaneous and Stimulated emission of radiation - Einstein's coefficients - Population inversion - Pumping Mechanisms - He-Ne laser, Nd-YAG laser - Applications of laser.

**Fiber Optics:** Introduction to Optical Fibers-Total Internal Reflection-Construction of optical fibers, Critical angle of propagation-Acceptance angle-Numerical Aperture-Classification of fibers based on Refractive index profile & modes –Propagation of electromagnetic wave through optical fiber- Block Diagram of Fiber optic Communication system -Applications.

**UNIT-V**

**Physics of Nanomaterials:** Introduction, Nano Science and Nanotechnology – Surface area to volume ratio and Quantum confinement- Classifications of Nanomaterials – Advantages of nanotechnology, Synthesis of nanomaterials- Top Down Process- Ball Milling; Bottom Up Process: Sol-Gel method– Applications.

**TEXT BOOKS**

1. H. J. Pain, *The Physics of vibrations and waves*, Wiley, 6<sup>th</sup> ed.2006.
2. K.Thyagarajan ,*Engineering Physics*, McGraw Hill Education Private Ltd, New Delhi,2<sup>nd</sup> ed.2019.

**REFERENCES**

1. E. Hecht, *Optics*, Pearson Education, 4<sup>th</sup> ed.2008.
2. O. Svelto, *Principles of Lasers*, Springer Science & Business Media, 5<sup>th</sup> ed.2010.
3. Halliday and Resnick, *Physics*,Wiley, 5<sup>th</sup> ed.2007.
4. W .Saslow, *Electricity, Magnetism and Light*, Academic Press,2<sup>nd</sup> ed.2002.

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**I B.Tech – I Sem**

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**(19CE0101) ENGINEERING MECHANICS**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Learn about forces and force systems and their applications*
2. *Learn about friction and to use the concept of Friction.*
3. *Learn how to find centroid of different objects using Mathematical formula.*
4. *Learn how to find Moments of Inertia of different objects using Mathematical formula.*

**COURSE OUTCOMES**

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

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

**UNIT – I**

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

**UNIT – II**

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

**UNIT – III**

**Centroid:** Centroids of Simple Figures (From Basic Principles)–Centroids of Composite Figures

**Centre of Gravity:** Centre of Gravity of Simple Body -Centre of Gravity of Composite Bodies Pappus Theorem

**UNIT – IV**

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

**UNIT – V**

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

**TEXT BOOKS**

1. Bhavikatti S, *A Textbook of Engineering Mechanics*, B.S. New Age International, 3rd Edition, 2016.
2. Dr. R. K. Bansal, *Engineering Mechanics*, Laxmi Publications, 4th Edition, 2011.

**REFERENCES**

1. D.S. Kumar, *Engineering Mechanics*, 3rd Edition, S.K. KATARIA & SONS
2. K. Vijaya Kumar Reddy, J. Suresh Kumar, *Singer's Engineering Mechanics: Statics and Dynamics*, 3rd Edition, B.S. Publications, 2011.
3. J L Meriam, L G Kraige, *Engineering Mechanics: Statics*, 6th Edition, Wiley India Pvt. Ltd, 2001.
4. J L Meriam, L G Kraige, *Engineering Mechanics: Dynamics*, 6th Edition, Wiley India Pvt. Ltd, 2010.

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**I B.Tech- I Sem**

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**(19HS0811) COMMUNICATIVE ENGLISH LAB**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Students will be exposed to a variety of self-instructional, learner friendly modes of Language learning.*
2. *Students will cultivate the habit of reading passages from the computer monitor. Thus Providing them with the required facility to face computer based competitive exams like GRE, TOEFL, and GMAT etc.*
3. *Students will learn better pronunciation through stress, intonation and rhythm.*
4. *Students will be trained to use language effectively to face interviews, group discussions, and public speaking.*
5. *Students will be initiated into greater use of the computer in resume preparation, report Writing, format making etc.*

**COURSE OUTCOMES**

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

1. *Remember and understand the different aspects of the English language proficiency with Emphasis on LSRW skills.*
2. *Apply communication skills through various language learning activities.*
3. *Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better Listening and speaking comprehension.*
4. *Evaluate and exhibit acceptable etiquette essential in social and professional Settings.*
5. *Create awareness on mother tongue influence and neutralize it in order to improve fluency In spoken English.*

**UNIT – I**

**Part-1**

Introduction to Phonetics

**Part-2**

Word Stress- Intonation

**UNIT – II**

**Part-1**

JAM - Oral Presentation

**Part-2**

Describing objects/places/persons- Minutes of Meeting

**UNIT – III**

**Part-1**

Situational dialogues – Greeting and Introduction -Telephonic Conversations

**Part-2**

Book Review-Report Writing

**UNIT – IV****Part-1**

Non-verbal Communication – Dumb Charade

**Part-2**

Debate/Group Discussion- Movie Review- Reading Comprehension.

**UNIT – V****Part-1**

Information Transfer

**Part-2**

Job Application and Resume Writing - Interview Skills

**Suggested Software:**

Walden InfoTech Software

**REFERENCES**

1. T. Balasubramanian, *A Textbook of English Phonetics for Indian Students*, Mcmillian Second edition, 2012.
2. Dhamija Sethi, *A Course in Phonetics and spoken English*, Prentice-hall of India Pvt. Ltd, 2000.
3. Krishna Mohan & NP Singh, *Speaking English Effectively*, Mcmillian, second Edition, 2011.
4. E.Sureshkumar&P.Sreehari, *A Hand Book of English Laboratories*, Foundation books,2011.
5. M Ashraf Rizvi, *Effective Technical Communication*, McGraw Hill Education, Second Edition, 27 July 2017.

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**(19HS0854) ADVANCED PHYSICS LAB**

**COURSE OBJECTIVES**

The objectives of this course is to

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

**COURSE OUTCOMES**

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

1. *Operate various optical instruments.*
2. *Estimate wavelength of laser and particles size using laser.*
3. *Plot the intensity of the magnetic field of induction along the axis of circular coil carrying current with distance.*
4. *Evaluate the acceptance angle of an optical fiber and numerical aperture.*
5. *Determine energy loss by B-H curve.*

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

1. Determination of wavelengths of various colours of Mercury vapour lamp using Diffraction Grating – Normal Incidence method.
2. Determination of Dispersive power of prism.
3. Rigidity Modulus – Tensional Pendulum
4. Determination of thickness of thin object by wedge method.
5. Determination of radius of curvature of Plano convex lens – Newton's Rings.
6. Determination of wavelength of a given laser source by using diffraction grating.
7. Determination of particle size (Lycopodium particles deposited on glass plates) using Laser source.
8. Determination of energy gap of a semi-conductor using p – n junction diode.
9. B- H curve.
10. Magnetic field along the axis of current carrying coil – Stewart & Gee's Method.
11. Determination of frequency of tuning fork - Melde's Apparatus.
12. Determination of Spring constant – Coupled Oscillator.
13. Determination of dielectric constant of dielectric material using charging and discharging of capacitor.
14. Determination of Numerical Aperture of an Optical fiber.
15. Measurement of resistance with varying temperature – Thermistor.

**REFERENCES**

1. S. Balasubramanian, M.N. Srinivasan, *A Text book of Practical Physics*, SChand Publishers, 2017.
2. <http://vlab.amrita.edu/index.php> -Virtual Labs, Amrita University.



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**I B.Tech – I Sem**

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**(19ME0301) WORKSHOP PRACTICE LAB**

**Part A- ENGINEERING WORKSHOP**

**COURSE OBJECTIVES**

The objectives of this course is to

- 1. Familiarize with the basic manufacturing processes and to study the various tools and Equipment*
- 2. Provides hands-on training in the trades of Carpentry, Fitting, and House-Wiring, and Tin Smithy.*
- 3. Overview of metal cutting processes, plumbing is provided through live demonstrations.*
- 4. Know the labor involved, machinery or equipment necessary, time required to fabricate.*
- 5. Acquire practical skills by performing the experiments in different shops of workshop*

**COURSE OUTCOMES**

On completion of the course the students will be able to

- 1. Describe various prototypes in the carpentry trade*
- 2. Illustrate different basic prototypes in the fitting trade*
- 3. Explain the method of preparation of various Tin smithy models*
- 4. Apply basic house wiring techniques in electric circuit connections*
- 5. Differentiate between soldering and brazing*
- 6. Estimate the amount of material required for various models*

**List of Experiments**

**Carpentry:** Familiarity with different types of woods and tools used in wood working and make following joints

1. T-Bridle joint
2. Corner Dovetail joint

**Sheet Metal Working:** Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job using GI sheets.

1. Tapered tray
2. Conical funnel

**Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises

1. Step Fitting
2. V-Fit

**Electrical Wiring:**

Familiarity with different types of basic electrical circuits and makes the following connections

1. Parallel and series
2. Two way switch
3. Go down lighting
4. Tube light
5. Three phase motor
6. Soldering of wires

**REFERENCES:**

1. V. Ramesh Babu, *Engineering Work shop practice for JNTU*, VRB Publishers Pvt. Ltd., 2009
2. P.Kannaiah & K.L.Narayana, *Work shop Manual*, SciTech Publishers, 2010

**Part B - IT WORKSHOP****COURSE OBJECTIVES**

*To provide hands-on experience with students in*

1. *Basic hardware*
2. *Productivity tools like MS Office*
3. *Basic operating system installations.*

**COURSE OUTCOMES**

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

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

**Task 1:**

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

**Task 2:**

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

**Task 3:**

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

**Task 4:**

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

**Productivity tools****Task 5:**

1. **MS Word Orientation:** Accessing, overview of toolbars, saving files, Using help and resources, rulers, formatting ,Drop Cap , Applying Text effects, Using Character Spacing, using templates, Borders and Colors, Inserting Header and Footer, Using Date and Time option, security features in word, converting documents while saving
2. **Presentations:** Creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyper linking, running the slide show, setting the timing for slide show. Students should submit a user manual of the Presentation tool considered.

3. **Spread sheet:** Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet application considered.

**Task 6:**

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

**TEXT BOOKS**

1. Peter Norton, *Introduction to Computers*, McGraw Hill, 2001
2. Joan Lambert, Joyce Cox, *MOS study guide for word, Excel, Power point & Outlook Exams*, PHI. 2008

**REFERENCES**

1. *Introduction to Information Technology*, ITL Education Solutions limited, Pearson Education.2009
2. Rusen, *Networking your computers and devices*, PHI, 2009
3. Bigelows, *Trouble shooting, Maintaining & Repairing PCs*, TMH, 2010

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**I B.Tech – II Sem**

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**(19HS0831) DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS**

**COURSE OBJECTIVES**

The objective of this course is to

1. *Enlighten the learners in the concept of differential equations and Multivariable calculus.*
2. *Furnish the learners with basic concepts and techniques at plus two levels to*
3. *Lead them into advanced level by handling various real world applications.*
4. *Develop the skill pertinent to the practice of the mathematical concepts including the*
5. *Students' abilities to formulate and modeling the problems, to think creatively and to*
6. *Synthesize information*

**COURSE OUTCOMES**

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

1. *Solve the differential equations related to various engineering fields*
2. *Identify solution methods for partial differential equations that model physical processes*
3. *Interpret the physical meaning of different operators such as gradient, curl and divergence*
4. *Estimate the work done against a field, circulation using vector calculus*
5. *Students will become familiar with applications of surface and volume integrals*

**UNIT – I**

**First and Higher Order Ordinary Differential Equation:** Exact - Linear and Bernoulli's equations - Second order linear differential equations with constant coefficients with R.H.S term of the types  $e^{ax}$ ,  $\sin ax$ ,  $\cos ax$ , polynomials in  $x^n$ ,  $e^{ax} V(x)$ .

**UNIT – II**

**Equations Reducible to Linear Differential Equations:** Method of variation of parameters - Cauchy's and Legendre's linear equations - Simultaneous linear equations with constant coefficients - Applications to L-C-R Circuit problems.

**UNIT – III**

**Partial Differential Equations:** Formation of P.D.E by eliminating arbitrary constants and functions. **Solutions of P.D.E:** Equations solvable by direct integration - Linear and non-linear equations of first order - Method of separation of variables.

**UNIT – IV**

**Vector Differentiation:** Scalar and vector point functions - Vector operator del - Del applies to scalar point functions – Gradient - Del applied to vector point functions - Divergence and Curl - Vector identities.

**UNIT – V**

**Vector Integration:** Line integral – Circulation - Work done - Surface and volume integrals. **Integral Theorems:** Green's theorem in the plane (without proof) - Stoke's theorem (without proof) - Divergence theorem (without proof) - applications of these theorems.

**TEXT BOOKS**

1. Dr.ShahnazBathul, *Engineering Mathematics*, Overseas Publishers PV.L.T,Fourth Edition,2008.
2. T.K.V. Iyengar, *Engineering Mathematics Volume-I*, S.Chand Publication, 5<sup>th</sup> Edition, 2010.

**REFERENCES**

1. E.Rukmangadachari & E.Keshava Reddy, *Engineering mathematics volume-I*, Pearson Publishers, 1<sup>st</sup> edition, 2015.
2. B. S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 42<sup>nd</sup> Edition, 2017
3. Peter V.Oneil, *Advanced Engineering Mathematics*, Thomson Books, 5<sup>th</sup> Edition, 2003
4. Dr. A Anjaudyulu, *Engineering Mathematics-I*, Deepthi Publications.
5. Erwin Kreyszig. *Advanced Engineering Mathematics*, John Wiley Publications,8<sup>th</sup> Edition, 2000

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**I B.Tech – II Sem**

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**(19HS0802) ENGINEERING CHEMISTRY**

**COURSE OBJECTIVES**

The objectives of this course is to

- 1. Familiarize engineering chemistry and its applications*
- 2. Impart the concept of soft and hard waters, softening methods of hard water*
- 3. Train the students on the principles and applications of electrochemistry, polymers, Surface chemistry and cement*

**COURSE OUTCOMES**

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

- 1. List the differences between temporary and permanent hardness of water, explain the principles of reverse osmosis and Electrodialysis. Compare quality of drinking water with BIS and WHO standards.*
- 2. Apply Nernst equation for calculating electrode and cell potentials, apply Pilling- Bed Worth rule for corrosion and corrosion prevention, demonstrate the corrosion prevention Methods and factors affecting corrosion, compare different batteries and their applications*
- 3. Explain different types of polymers and their applications, solve the numerical problems Based on Calorific value, select suitable fuels for IC engines, explain calorific values octane Number, refining of petroleum and cracking of oils.*
- 4. Explain the constituents of Composites and its classification identify the factors affecting the refractory material, illustrate the functions and properties of lubricants, and demonstrate the phases and reactivity of concrete formation.*
- 5. Summarize the applications of SEM, TEM and X-ray diffraction in surface characterization, Explain the synthesis of colloids with examples, outline the preparation of nano materials, And metal oxides identify the application of colloids and nano materials in medicine, sensors And catalysis.*

**UNIT – I**

**Water Technology:** Introduction, Soft water and Hardness of water, Estimation of hardness by EDTA Method. Boiler troubles, Municipal water treatment, Industrial water treatment, Specifications for drinking water - Bureau of Indian Standards (BIS) and World Health Organization (WHO) standards, Zeolite and Ion-exchange processes. Desalination of brackish water - Reverse osmosis (RO) and Electrodialysis.

**UNIT – II**

**Electrochemistry and Applications:** Electrochemical cell, Nernst equation, Cell potential calculations. Primary cells Li Battery. Secondary cells-Lead acid Battery and Lithium ion cell (Rechargeable) - working of the batteries including cell reactions. Fuel cells-Basics principles and working principles of Hydrogen-Oxygen, Methanol-Oxygen fuel cells.

**Corrosion:** Introduction to Corrosion, Types of Corrosion (Chemical or Dry Corrosion, Electrochemical or Wet corrosion), Differential aeration cell corrosion, Galvanic corrosion, Pilling-Bedworth ratios and uses, Factors affecting the corrosion-Cathodic and Anodic protection, Electroplating (Nickel and Copper) and Electroless plating.

### UNIT – III

**Polymers and Fuel Chemistry:** Introduction to Polymers, Functionality of monomers Nomenclature of Polymers, Mechanism of Chain growth, Step growth polymerization. Thermoplastics and Thermosetting plastics- preparation, properties and applications of PVC and Bakelite. Elastomers – Preparation, properties and applications of Buna-S, Buna-N, Thiokol.

**Fuels:** Types of fuels, Calorific value, Numerical problems based on calorific value, Analysis of coal, Liquid fuels, Refining of Petroleum, Fuels for IC engines, Knocking and Anti-knock agents, Octane and Cetane values, Cracking of oils, Alternative fuels- Propane, Methanol Ethanol and Bio fuels.

### UNIT – IV

**Basic Engineering Materials:** Composites - Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, Properties and Engineering applications. Refractories – Classification, Properties. Lubricants- Classification, Mechanism, Properties of lubricating oils and Applications. Building materials- Manufacture of Portland Cement, constituents, phases and reactivity of clinker, Setting and Hardening of Cement.

### UNIT – V

**Surface Chemistry and Applications:** Introduction to Surface chemistry, Colloids, Micelle formation, Synthesis of colloids (any two methods with examples), Chemical and Electrochemical methods (not more than two methods) of preparation of nanometals and metal oxides, Stabilization of colloids and nanomaterials by stabilizing agents, Characterization of surface by physicochemical methods (SEM, TEM, X-ray diffraction), Solid-gas interface, Solid-liquid interface, adsorption isotherm, BET equation (no derivation), Applications of colloids and Nanomaterials – catalysis, medicine, sensors, etc.

### TEXT BOOKS

1. K N Jayaveera, GV Subba Reddy and C. Ramachandraiah, *Engineering Chemistry*, McGraw Hill Higher Education, Forth Edition, New Delhi, 2019.
2. Jain and Jain, *A Text Book of Engineering Chemistry*, Dhanapathi Rai Publications, New Delhi, 2010.

### REFERENCES

1. S.S Dhara, *A Text book of Engineering Chemistry*, S. Chand Publications, New Delhi, 2010.
2. K.B.ChandraSekhar, UN.Das and Sujatha Mishra, *Engineering Chemistry*, Scitech Publications India Pvt Limited, 2015.
3. H.D. Gesser, *Applied Chemistry*, Springer International Edition, 2010.

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**I B.Tech – II Sem**

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**(19CS0501) PYTHON PROGRAMMING**

**COURSE OBJECTIVES**

*The objectives of this course is to*

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

**COURSE OUTCOMES**

*On completion of the course the students will be able to*

- 1. Making Software easily right out of the box*
- 2. Solve the problems using control structures, input and output statements*
- 3. Summarize the features of lists, tuples, dictionaries, strings and files*
- 4. Experience the usage of standard libraries, objects, and modules*
- 5. Identify build the software for real needs.*

**UNIT- I**

**Introduction:** Algorithms -Building blocks of flow-chart design -History of Python -Python features – Applications - Programming Using the REPL(Python Shell) - Running Python Scripts – Variables – Assignment – Keywords - Input-Output - Indentation.

**Data Types:** Data Type – Types of data: Single Valued and Multi valued data types.

**Single Valued:** Numbers - Strings and methods - Booleans.

**UNIT- II**

**Data Structures:** Lists – Tuples – Sets - Dictionaries and Sequences - Indexing and slicing - Comprehensions -**Type Casting:** Conversion methods.

**Operators and Expressions:** Operators-Types of operators - Expressions and order of evaluations.

**Control Flow:** Simple if - if else- nested if - if-elif-else –looping: while and for -Jumping: break – continue - pass

**UNIT-III**

**Functions :** Defining Functions - Calling Functions - Passing Arguments - Keyword Arguments – Default Arguments - Variable-length arguments - Anonymous Functions - Fruitful Functions(Function Returning Values) - Nested functions - Recursive functions - Scope of the Variables in a Function - Global and Local Variables.

**Object Oriented Programming in Python:** Classes - Class diagram – Constructor - Object- self variable - Methods - Magic methods – Inheritance – Polymorphism - Method overloading -Overriding Methods.



**UNIT-IV**

**Modules:** Creating modules - Import statement - From Import statement - Name spacing

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

**Exception Handling:** Introduction - try except block - try else – finally - Raising Exceptions - User Defined Exceptions

**Introduction to Regular Expressions** – Searching and Matching

**UNIT V**

**Functional Programming:** Iterators and Generators - Maps and Filters

**Files:** Text files- Reading and Writing files - Command line arguments;

**Brief Tour of the Standard Library** - Dates and Times - Data Compression - Python Runtime Services – Mathematics - Data Management and Object Persistence

**GUI Programming** - Turtle Graphics

**TEXT BOOKS**

1. VamsiKurama, *Python Programming, A Modern Approach*, Pearson
2. ReemaThareja, *Python Programming - Using Problem Solving Approach*, First Edition (English, Paperback)

**REFERENCES**

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

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**I B.Tech – II Sem**

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**(19ME0302) ENGINEERING GRAPHICS**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Understand the importance graphics in engineering*
2. *Develop the basic graphical skills for communication of concepts, ideas and design of Engineering Products through engineering drawings.*
3. *Increase ability to take data and transform it into graphic drawings*
4. *Provide skills in reading and Interpretation of Engineering Drawings*
5. *Visualize and draw Orthographical views and Isometric views of the objects*

**COURSE OUTCOMES**

On completion of the course the students will be able to

1. *Appreciate the usage of engineering curves in tracing the paths of simple machine components*
2. *Understand the concept of projection and acquire visualization skills, projections of Points*
3. *Draw the projections of geometrical solids and sectional view of solids*
4. *Understand the concept of projection and acquire visualization skills, development of surfaces and interpenetrations of solids*
5. *Draw multi view orthographic and other projections including isometric*
6. *Draw the basic views related to projections of lines and planes*

**UNIT – I**

**Introduction To Engineering Drawing:** Principles of Engineering Graphics and their significance - usage of Drawing instruments – lettering - Conic sections, Cycloids and Involute.

**UNIT – II**

**Projections of Points:** - Principles of Orthographic Projections-Conventions - Projections of Points

**Projections of Straight Lines:** - Inclined to both the planes (Trapezoidal Method & Rotating line method) - simple problems only, Traces

**Projections of Planes:** Surface inclined to both reference planes

**UNIT – III**

**Projections of Solids:** Introduction – Projections of right regular solids-Prisms, Pyramids in different positions. (Inclined to one plane only)

**Sections of Solids:** Sectional Views of Right regular Solids - Prisms, Pyramids.

**UNIT – IV**

**Development of Surfaces:** - Development of surfaces of Right Regular Solids - Prisms, Pyramids.

**Interpenetration of Solids:** Cylinder to Cylinder, Prism to Prism, Cone to Cone (simple Problems Only)

**UNIT – V**

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

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

#### TEXT BOOKS

1. Basant Agarwal & CM Agarwal, *Engineering Drawing & Graphics*, Mcgraw Hill Education, 2013.
2. K.L.Narayana, Kannaiah, *A text Book of Engineering Drawing*, Scitech Publishers, 2010.

#### REFERENCES

1. N.D.Bhatt, Charotar, *Engineering Drawing*, Publishers, 2011.
2. K.Venugopal, *A text Book of Engineering Drawing and Graphic*, New Age Publishing New Delhi, 2008.
3. P.J.Shah, *A Text Book of Engineering Graphics*, S.Chand & Company Ltd., New Delhi, 2016
4. R.K.Dhawan, *A text book of Engineering Drawing*, S.Chand & Company Ltd., New Delhi, 2013.

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**I B.Tech -II Sem**

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**(19ME0303) MATERIALS ENGINEERING**

**COURSE OBJECTIVES**

The objectives of this course is to

- 1. Understand the Structure of Metals and Constitution of Alloys.*
- 2. Identify different types of Equilibrium Diagrams for metals and alloys.*
- 3. Differentiate Ferrous and Nonferrous metals.*
- 4. Recognize the importance of Heat treatment process of alloys and Fracture mechanism.*
- 5. Explain the usage of Composites materials and Ceramic materials in Industries*

**COURSE OUTCOMES**

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

- 1. Elaborate a broad knowledge on different properties of materials with respect to grain size*
- 2. Discuss the different types of Equilibrium Diagrams.*
- 3. Describe the various properties of Ferrous and Non Ferrous Metals.*
- 4. Illustrate the concept of heat treatment of steels & strengthening mechanisms*
- 5. Identify the method of manufacturing of different Composite materials.*
- 6. Classify and distinguish different types of ferrous and non ferrous alloys*

**UNIT – I**

**Structure of Metals:** Classification of Materials - Engineering properties of Materials- Bonds in Solids, Metallic bond - Crystallization of Metals - Grain and Grain boundaries, Effect of grain boundaries on the properties of metal / alloys, Determination of grain size

**Constitution of Alloys:** Necessity of alloying - Types of solid solutions - Hume Rothery's rules - Intermediate alloy phases, and Electron compounds - BIS.

**UNIT-II**

**Equilibrium of Diagrams:** Experimental methods of construction of equilibrium diagrams - Isomorphous alloy systems - Equilibrium cooling and heating of alloys - Lever rule - Coring miscibility gaps - Eutectic systems - Congruent melting intermediate phases -Peritectic reaction.

**Transformations in the solid state:** Allotropy - Eutectoid, Peritectoid reactions - Phase rule - Relationship between equilibrium diagrams and properties of alloys - Study of important binary phase diagrams of Cu-Ni, Al-Cu, and Fe-Fe<sub>3</sub>C.

**UNIT-III**

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

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

**UNIT-IV**

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

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

**UNIT-V**

**Ceramic Materials:** Crystalline ceramics – Glasses – Cermet - Polymeric Materials

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

**TEXT BOOKS**

1. Sidney H. Avner, *Introduction to Physical Metallurgy*, Tata McGraw- Hill, 2nd Edition, US, 2007.
2. R.K.Rajput, *Engineering Materials and Metallurgy*, S.Chand, 3rd Edition, 2008

**REFERENCES**

1. Dieter, *Mechanical Metallurgy*, G. E., McGraw Hill, 3rd Edition Singapore, 2012.
2. Dr.Kodgire, *a Text Book of Material Science and Metallurgy for Engineers*, V.D, Everest Publishing House, 12<sup>th</sup> Edition, 2007.
3. J F Shackelford, *Introduction to Material Science for Engineers*, Pearson Publishers, 8th Edition, 2014.

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**I B.Tech -II Sem**

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**(19HS0806) ENGINEERING CHEMISTRY LAB**

**COURSE OBJECTIVES**

The objective of this course is to

1. *Verify the fundamental concepts with experiments*

**COURSE OUTCOMES**

On Completion of the course the students will be able to

1. *Determine the cell constant and conductance of solutions*
2. *Prepare advanced polymer materials*
3. *Estimate the Iron and Calcium in cement*
4. *Calculate the hardness of water*
5. *Determination of conductivity of an acid*

**List of Experiments:**

1. Conduct metric Titration of Strong acid vs Strong base
2. Conduct metric Titration of Weak acid vs. Strong base
3. Determination of Hardness of a Groundwater sample.
4. pH metric titration of Strong acid vs. Strong base,
5. Potentiometry - Determination of Redox potentials and emfs
6. Determination of Strength of an Acid in Pb-Acid battery
7. Preparation of a Polymer
8. Determination of viscosity of oil by Redwood viscometer.
9. Determination of percentage of Iron in Cement sample by Colorimetry
10. Estimation of Calcium in Port land Cement
11. Adsorption of Acetic acid by Charcoal
12. Determination of Percentage Moisture content in a Coal sample

**TEXT BOOKS:**

1. J. Mendham et al, *Vogel's Text book of Quantitative Chemical Analysis*, Pearson Education, Sixth Edition, 2002.
2. Chandra Sekhar, G.V. Subba Reddy and Jayaveera, *Chemistry Practical – Lab Manual*, McGraw Hill Higher Education, 2015.

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**I B.Tech – II Sem**

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**(19CS0502) PYTHON PROGRAMMING LAB**

**COURSE OBJECTIVES**

The objective of this course is to

- 1. The course provides hands-on training in usage of basic concepts, control structures, data Structures, object oriented programming, exceptional handling and plotting of graphical Entities.*

**COURSE OUTCOMES**

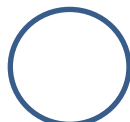
On completion of the course the students will be able to

- 1. Ability to program on basic concepts, control structures.*
- 2. Ability to implement data structures and their operations*
- 3. Ability to work on object oriented programming*
- 4. Ability to handle exceptional handling and plotting of graphical entities.*
- 5. Ability to develop any real world problem*

**List of Experiments:**

1. Implement the following tasks
  - a) Write a python program to check whether the number is positive or negative.
  - b) Write a python program to find whether a given number is even or odd.
  - c) Write a python program to find biggest number among three numbers.
2. Implement the following tasks
  - a) Write a python program to displaying reversal of a number.
  - b) Write a python program to print factorial of a number
  - c) Write a python program to generate prime numbers series up to N
3. Implement following problems using python script
  - a) Swapping of two number with and without using temporary variable.
  - b) If the age of Ram, Sam, and Khan are input through the keyboard, write a python program to determine the eldest and youngest of the three.
  - c) Arithmetic operations (Addition, Subtraction, Multiplication, and Division) on integers. Input the two integer values and operator for performing arithmetic operation through keyboard.
4. Implement the following tasks
  - a) Implement the python program to generate the multiplication table.
  - b) Implement Python program to find sum of natural numbers
  - c) If the first name of a student is input through the keyboard, write a program to display the vowels and consonants present in his/her name.
5. Implement the following tasks
  - a) The marks obtained by a student in 5 different subjects are input through the keyboard. Find the average and print the student grade as per the SIETK examination policy.
  - b) Given a number x, determine whether it is Armstrong number or not.  
Hint: For example, 371 is an Armstrong number since  $3^3 + 7^3 + 1^3 = 371$ . Write a program to find all Armstrong number in the range of 0 and 999.

6. Implement the following tasks
  - a) Write a Python script to
    - create a list
    - access elements from a list
    - slice lists
    - change or add elements to a list
    - delete or remove elements from a list
  - b) Write a Python script to read the values from a list and to display largest and smallest numbers from list.
  - c) Write a Python script to compute the similarity between two lists.
7. Implement the following tasks
  - a) Write a Python script to read set of values from a Tuple to perform various operations.
  - b) Write a Python script to perform basic dictionary operations like insert, delete and Display.
  - c) Write a Python program to count the occurrence of each word in a given sentence.
8. Implement the following tasks
  - a) Write a Python script to create Telephone Directory using dictionary and list to perform basic functions such as Add entry, Search, Delete entry, Update entry, View and Exit.
  - b) Implement Python script to display power of given numbers using function.
  - c) Implement a Python program that takes a list of words and returns the length of the Longest one using function.
9. Implement the following tasks
  - a) Implement Python program to perform various operations on string using string libraries.
  - b) Implement Python program to remove punctuations from a given string.
  - c) Write a Python program to change the case of the given string (convert the string from lower case to upper case). If the entered string is “computer”, your program should output “COMPUTER” without using library functions.
10. Implement the following tasks
  - a) Implement Python program to capitalize each word in a string. For example, the entered sentence “god helps only people who work hard” to be converted as “God Helps Only People Who Work Hard”
  - e) Write a Python script to display file contents.
  - f) Write a Python script to copy file contents from one file to another.
11. Implement the following tasks
  - a) Write a Python script to combine two text files contents and print the number of lines, sentences, words, characters and file size.
  - b) Write a Python commands to perform the following directory operations.
    - List Directories and Files
    - Making a New Directory
    - Renaming a Directory or a File
    - Removing Directory or File
12. Implement the following tasks
  - a) Create a package named Cars and build three modules in it namely, BMW, Audi and Nissan. Illustrate the modules using class. Finally we create the \_\_init\_\_.py file. This file will be placed inside Cars directory and can be left blank or we can put the initialization code into it.
  - b) Write a python script to display following shapes using turtle.





**TEXT BOOKS**

1. Vamsi Kurama, *Python Programming: A Modern Approach*, Pearson
2. Reema Thareja, *Python Programming - Using Problem Solving Approach*, First Edition (English, Paperback), Oxford University Press.

**REFERENCES**

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

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**I B.Tech- II Sem**

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**(19HS0816) INDIAN CONSTITUTION**

**COURSE OBJECTIVES**

The objectives of this course is to

- 1. Know the premises informing the twin themes of liberty and freedom from a civil Rights perspective.*
- 2. Address the growth of Indian opinion regarding modern Indian intellectuals Constitutional role*
- 3. Address entitlement to civil and economic rights as well as the emergence of Nationhood in the early years of Indian nationalism.*
- 4. Address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution*
- 5. Acquire knowledge for various competitive examinations*

**COURSE OUTCOMES**

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

- 1. Explain the key concepts of political economy*
- 2. Analyze the significant developments in the political ideologies*
- 3. Describe the salient features of the constitution of India interpret, integrate and critically*
- 4. Analyze the political economy of Indian international relations and gain knowledge in Judiciary system.*
- 5. Apply their knowledge and skills acquired to write various competitive examinations.*

**UNIT-I**

Introduction to the Constitution

**UNIT-II**

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

**UNIT-III**

Scheme of the fundamental rights-The scheme of the Fundamental Duties and its legal status-The Directive Principles of State Policy – Its importance and implementation

**UNIT-IV**

Parliamentary Form of Government in India – Powers and Functions-The President of India - Status and Powers -The historical perspectives of the constitutional amendments in India-Judiciary system - Powers and Functions

**UNIT-V**

Local Self Government – Constitutional Scheme in India -Election Commission: Role and Functions

**TEXT BOOKS**

1. Government of India Ministry of Law and Justice (Legislative Department), *The Constitution of India, 1950 (Bare Act)* Government Publication, 2015
2. Dr. S. N. Busi *Dr. B. R. Ambedkar, framing of Indian Constitution*, 1st Edition, Government Publication 2015.

**REFERENCES**

1. M. P.Jain, *Indian Constitution Law* Lexis Nexis 7th Edn.,2014.
2. D.D. Basu, *Introduction to the Constitution of India* Lexis Nexis,2015.
3. P.M.Bakshi, *Constitution of India* Universal Law Publishing. 15<sup>th</sup> Edition,2018.

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**II B.Tech -I Sem**

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**(19EE0240) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**

**COURSE OBJECTIVES**

The objectives of this course is to

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

**COURSE OUTCOMES**

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

1. *Determine the equivalent impedance of a given network by using network reduction techniques.*
2. *Calculate the voltage and current for a given particular network by using KCL&KVL.*
3. *Analyze the working operation & characteristics of DC generators.*
4. *Understand the construction of DC motors and transformer.*
5. *Analyze the operating principles of major electronic devices, its characteristics and application*
6. *Design and analyze the DC bias circuitry of BJT and FET.*

**PART-A**

**UNIT- I**

**Introduction to Electrical Engineering:** Ohm's Law – Basic Circuit Components -Kirchhoff's Laws –Types of Sources –Resistive Networks, Inductive Networks, Capacitive Networks –Series Parallel Circuits, Star Delta and Delta Star Transformation - Principle of AC Voltages, Root Mean Square and Average Values of Alternating Currents and Voltage –Form Factor and Peak Factor.

**UNIT- II**

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

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

**UNIT- III**

**DC Motors:** Principle of Operation of DC Motors, Types of DC Motors, Torque Equation, Losses and Efficiency calculation in DC Motor - Applications.

**Transformers:** Principles of Operation, EMF equation, Losses and Efficiency, Regulation of Transformer.

## PART B

### UNIT I

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

### UNIT II

**BJT:** Bi polar Junction Transistor (BJT)–Types of Transistors, Operation of n-p-n and p-n-p Transistors, Input-Output Characteristics of BJT-CB,CE and CC Configurations, Relation Between  $I_C$ ,  $I_B$  and  $I_E$  –Transistor Biasing-Fixed Bias – Transistor Applications- Transistor as an Amplifier, Transistor as a Switch.

### UNIT III

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

### TEXT BOOKS

1. M.S. Naidu and S. Kamakshiah, *Basic Electrical Engineering*, TMH, 2011
2. T.K. Nagasarkar and M.S. Sukhija, *Basic Electrical Engineering*, Oxford University Press, 2005.

### REFERENCES:

1. D.P. Kothari & I.J. Nagrath, *Theory and Problems of Basic Electrical Engineering*, PHI, 2009
2. V. K Mehta, *Principles of Electrical Engineering*, S. Chand Publications, 2011
3. T. Thyagarajan, *Fundamentals of Electrical Electronics Engineering*, SCITECH Publications 5th Edition, 2007.
4. Hughes, *Electrical and Electronic Technology*, Pearson Education, 2012.

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**II B.Tech - I Sem**

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**(19CE0150) STRENGTH OF MATERIALS**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Learn about simple stresses and strains and their application.*
2. *Learn how to find shear forces and bending moments and construction of SFD & BMD.*
3. *Understand about the concept of simple bending, shear stress distribution & deflection of Beams.*

**COURSE OUTCOMES**

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

1. *Summarize the basic principles of elasticity, theory of failures and apply them to estimate the stress and strain for axial members.*
2. *Draw shear force and bending moment diagrams under different loading conditions*
3. *Study the theories related to the bending stress, shear stress distribution and torsional stress for beams of different cross-sections and their applications.*
4. *Describe the slope and deflection of beam and calculate the slope and deflection for statically determinate beams by using different methods.*
5. *Classify different type of column and derive Euler's equation for long columns with different end conditions.*
6. *Analyze the pressure vessels subject to internal and external fluid pressure.*

**UNIT – I**

**Simple Stresses and Strains:** Elasticity and plasticity – Types of stresses and strains – Hooke's law – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – Composite bars – Temperature stresses – Principal Stress – Mohr's Circle

**Theories of Failures:** Various theories of failures like Maximum Principal stress theory – Maximum principal strain theory – Maximum shear stress theory – Maximum strain energy theory – Maximum shear strain energy theory

**UNIT – II**

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

**Theory of Simple Bending:** Derivation of flexure formula:  $M/I = f/y = E/R$  – Section Modulus

**UNIT – III**

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

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

**UNIT – IV**

**Deflections of Beams:** Slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods for finding slope and deflection for cantilever and simply supported beams with point load, uniformly distributed load, gradually varying load, and combination loads.

**Columns:** Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns – assumptions – derivation of Euler's critical load formulae for various end conditions.

**UNIT – V**

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

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

**TEXT BOOKS**

1. Dr. R. K. Bansal, *A Textbook of Strength of Materials*, Laxmi Publications, 6<sup>th</sup> Edition, 2017.
2. Er. R. K. Rajput, *Strength of Materials (Mechanics of solids)*, S. Chand Publishing, 6<sup>th</sup> Edition, 2015.

**REFERENCES**

1. Dr. B. C. Punmia, Dr. Ashok Kr. Jain, Dr. Arun Kumar Jain, *Mechanics of Materials*, Laxmi Publications, Revised Edition, 2016.
2. R. S. Khurmi, *Strength of Materials*, S. Chand Publishing, 24<sup>th</sup> Edition, 2015.
3. R. Subramanian, *Strength of Materials*, Oxford University Press, 3<sup>rd</sup> Edition, 2010.

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**(19CE0151) FLUID MECHANICS & HYDRAULIC MACHINERY**

**COURSE OBJECTIVES**

The objective of the course is to

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

**COURSE OUTCOMES**

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

1. State Newton's Law of Viscosity, discuss and calculate fluid properties.
2. Define Pascal's Law and applies it for measuring pressure devices.
3. Classify various fluid flows and derive continuity, Euler's, Bernoulli's, Impulse Momentum, Darcy Weisback Equation and applying them for fluid flow problems and pipe flow Problems.
4. Analyze impact of jets on vanes and develop velocity triangle.
5. Discuss operation principals of hydroelectric power plant.
6. Explain the principals of pumps and turbine.

**UNIT-I**

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

**Fluid Statics:** Pascal's law - Pressure variation in a static fluid – Atmospheric, gauge and absolute pressures, Measurement of pressure – Piezometer – U-tube and Inverted U-tube manometers and Bourdon's pressure gauge.

**UNIT-II**

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

**Fluid Dynamics:** Euler's equation of motion along a streamline – Bernoulli's energy equation – Energy correction factor – Impulse momentum equation – Momentum correction factor – Force on a bend – Energy gradient line – Hydraulic gradient line.

**UNIT-III**

**Flow Measurement:** Velocity measurement by Pitot tube and Pitot static tube – Discharge measurement by Venturimeter and orifice meter.

**Analysis of Pipe Flow:** Loss of head through pipes - Darcy Weisbach equation - Minor losses in pipe flow - Pipes in Series - Pipes in Parallel - Analysis of Pipe Networks - Hardy Cross Method.



**UNIT- IV**

**Impact of Jets:** Analysis of free liquid jets – Forced vortex and free vortex - Hydrodynamic force of jets on stationary and moving flat inclined and curved vanes - Jet striking centrally and at tip - Velocity triangles at inlet and outlet - Expressions for work done and efficiency- Angular momentum principle.

**Introduction to Hydroelectric Power Plant:** Types of hydroelectric power plant - Heads and efficiency of power plants – Components of dam type power plant.

**UNIT -V**

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

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

**TEXT BOOKS**

1. Dr.P.N.Modi & Dr.S.M.Seth, *Hydraulics and Fluid Mechanics Including Hydraulics Machines*, Standard Book House, 20<sup>th</sup> Edition, 2015.
2. Dr. R. K. Bansal, *A Textbook of Fluid Mechanics and Hydraulic Machines*, LaxmiPublications, 9<sup>th</sup> Edition, 2017.

**REFERENCES**

1. Streeter, Wylie, Bedford, *Fluid Mechanics*, McGraw Hill Education, 9<sup>th</sup> Edition, 2017.
2. C.S.P. Ojha, R. Berndtsson & P.N. Chandamouli, *Fluid Mechanics and Machinery*, Oxford University Press, 1<sup>st</sup> Edition, 2010.
3. S. C. Gupta, *Fluid Mechanics and Hydraulic Machines*, Pearson India Education Services Pvt. Ltd, 1<sup>st</sup> Edition, 2006.
4. Rama Durgaiah D., *Fluid Mechanics and Machinery*, New Age International, 1<sup>st</sup> Edition, 2007.

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**(19ME0304) KINEMATICS OF MACHINERY**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Basic concepts of mechanisms and their kinematic Inversions.*
2. *Effects of mechanism with lower pair and steering mechanism in machine components.*
3. *Velocity and Acceleration concept of Kinematics components.*
4. *Drawing concept of Cam and Cam Profile.*
5. *Working concept of gear profile and gear train.*
6. *Applications of kinematics in real time problems.*

**COURSE OUTCOMES**

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

1. *Identify common mechanisms used in machines.*
2. *Find different mechanisms, Inversions of kinematic chains.*
3. *Carryout analysis on different types of links, position, velocity, acceleration.*
4. *Understand drafting concepts of Cam and Cam profile.*
5. *List out different types of gears and their profiles.*
6. *Explain the concept of Real time kinematic mechanisms.*

**UNIT-I**

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

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

**UNIT-II**

**Mechanisms With Lower Pairs:** Straight line motion mechanisms, Peaucellier, Hart, Scott Russell, Grasshopper, Watt, Tchebicheff, Robert and pantograph.

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

**UNIT-III**

**Kinematics:** Displacement, Velocity and Acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration of polygons.

**Velocity Analysis:** Instantaneous centers – Kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration.

**UNIT-IV**

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

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

**UNIT-V**

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

**Gear Trains:** Speed ratio, Train value – Parallel axis gear trains – Epicyclic Gear Trains, Differential gear of automobile, simple problems only.

**TEXT BOOKS**

1. S.S. Rattan, *Theory of Machine*, Tata McGraw-Hill publications, 3<sup>rd</sup> Edition, 2013.
2. R.S Khurmi, *Theory of Machine*, S Chand Publications, 14<sup>th</sup> Edition, 2005.

**REFERENCES**

1. J.E. Shigley, *Theory of Machines and Mechanisms*, Oxford University Press publisher, 4<sup>th</sup> Edition, 2010.
2. R.L. Norton, *Kinematics and dynamics of machinery*, Tata McGraw-Hill publications, 1<sup>st</sup> Edition, 2013.
3. Thomas Bevan, *Theory of Machines*, Pearson (P) publisher, 3<sup>rd</sup> Edition, 2009.

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**(19CE0136) WATER TECHNOLOGY  
[Open Elective- I]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Develop a student's skill in evaluating the performance of water treatment plants.*
2. *Communicate the importance of conserving water.*
3. *Outline the strategies for reducing water consumption.*
4. *Minimize the risks of floods, droughts and landslides.*
5. *Develop rural areas in the region with clear plans for improving the economy of the regions.*

**COURSE OUTCOMES**

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

1. *Underline the importance of water and describe the mechanism of hydrological cycle.*
2. *Describe various elements associate with public water supply.*
3. *Describe water quality criteria and standards, and their relation to public health.*
4. *Recognize the cause of water pollution and influence of climatic changes on water resources.*
5. *Summarize various water conservation techniques in practice.*
6. *Explain need for watershed management and implement various Plans for watershed management.*

**UNIT-I**

**Water Demand and Sources of Water:** Water demand -Types of water demands- Per capita Demand- Factors affecting the per capita demand – Water cycle-Sources of water-Surface and subsurface sources - Factors governing the selection of source of water - Water deficiency-Water crisis.

**Introduction to Water Supply:** Importance and Necessity of protected water supply systems - Objectives of protected water supply system- Flow chart of public water supply system.

**UNIT-II**

**Water Quality:** Requirement of water for domestic use-Impurities in water- Characteristics of water-Water quality standards – Flow chart of basic treatment process- Latest treatment process-Membrane filtration-Reverse process- Desalination process.

**UNIT-III**

**Water Pollution:** Surface water pollution – Causes - Remedial measures – Ground water pollution – Causes – Remedial measures.

**Climatic Changes on Water Resources:** Impact of climatic changes on water resources- Droughts- Extreme Precipitation- Melting Glaciers and Snow Drought- Greenhouse Gas emissions- Algal blooms.

**UNIT-IV**

**Water Conservation:** Definition – Rain-water harvesting– Advantages of implementing the rain-water harvesting–Components of roof top rain-Water harvesting-Techniques in rain water harvesting–Catchment harvesting-Check dams-Farm ponds-Percolation tank-Ground water recharge-Ground water recharge structures.

**UNIT-V**

**Watershed Management:** Definition – Concept of Watershed Management-Need for watershed management- Objectives of watershed management-Characteristics of watershed – Planning of watershed management.

**TEXT BOOKS:**

1. Modi P.N., Water Supply & Waste Water Engineering, Vol. I & II, Standard Book House, New Delhi,2010.
2. J.V.S.Murty, Watershed Management, New Age International Publications, New Delhi,2<sup>nd</sup> EditionReprint,2004.

**REFERENCES:**

1. Garg, S.K., *Environmental Engineering Vol.I& II*, Khanna Publishers, New Delhi,2015.
2. Madan Mohan Das, Mimi Das Saikia, *Watershed Management*, PHI Learning Pvt. Ltd.Delhi,2013.
3. Ghanshyam Das, *Hydrology and Soil Conservation Engineering: Including Watershed Management*, PHI Learning Pvt. Ltd., Delhi. 2<sup>nd</sup> Edition, 2009.
4. <https://theberkey.com/pages/a-guide-to-water-conservation>    <https://blog.mygov.in/water-conservation-rainwater-harvesting/><https://theconstructor.org/water-resources/methods-rainwater-harvesting/5420/>
5. Links for “Climatic Changes on Water Resources”  
<https://ascelibrary.org/doi/10.1061/%28ASCE%29EE.1943-7870.0001394>  
<https://www.watercalculator.org/footprint/climate-change-water-resources/><https://19january2017snapshot.epa.gov/climate-impacts/climate-impacts-water-resources.html>

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**(19EE0238) GENERATION OF ENERGY THROUGH WASTE  
[Open Elective- I]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Understand different types of waste as fuel.*
2. *Introduce Pyrolysis methods and conversion processes.*
3. *Understand gasification methods for biomass.*
4. *Learn concepts of biomass resources, combustion types and biogas plant technology.*

**COURSE OUTCOMES**

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

1. *Analyze agro based, forest residue and industrial waste conversion processes.*
2. *Manufacture of Pyrolytic oils and gases.*
3. *Manufacture of charcoal, yields and applications.*
4. *Understand various types of gasifiers operation.*
5. *Understand inclined and fluidized bed combustors operation.*
6. *Understand types of biogas plants and biomass energy Programming India.*

**UNIT- I**

**Introduction to Energy from waste:** Classification of waste as fuel – Agro based- Forest residue- Industrial waste- MSW- conversion devices- Incinerators-Gasifiers-Digestors.

**UNIT- II**

**Bio-mass Pyrolysis:** Pyrolysis- Types- Slow-Fast- Manufacture of Charcoal- methods- yields and application. Manufacture of Pyrolytic oils and gases – yields and applications.

**UNIT- III**

**Biomass Gasification:** Gasifiers- Fixed bed system- Downdraft and Updraft gasifiers- Fluidized bed gasifiers- construction and operation- Gasifier burner arrangement for thermal heating.

**UNIT- IV**

**Biomass Combustion:** Biomass stoves- Types- Inclined combustors- Fluidized bed combustors- construction and operation of above biomass combustors.

**UNIT- V**

**Properties of Biogas:** Biogas plant Technology and status – Biomass resources and their classification- Biomass conversion processes- thermo chemical conversion – Direct Combustion- Biomass gasification- Pyrolysis and liquefaction – bio-chemical conversion- anaerobic digestion- Types of biogas plants- applications-Biomass Energy Programme in India.

**TEXT BOOKS**

1. Desai Ashok V. *Non-Conventional Energy*, Wiley Eastern Ltd Reprint, 2003.
2. Khandelwal K.C. and Mahdi SS, *Biogas Technology – A Practical Hand Book*, Vol I & II. Tata McGraw Hill Publishing Co Ltd., 1983.

**REFERENCES**

1. Challal D.S, Food, *Feed and Fuel from Biomass*, Asia Publishing House, 1991.
2. GD Roy, *Non-conventional Energy Sources*, Khanna Publishers, 6<sup>th</sup> Edition, 1988.
3. KhahidRehmanHekeem, Mohammad Jawald, Umar Rashid, *Biomass & Bioenergy*, Springer International Publishing Ltd.

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**(19EC0448) INTRODUCTION TO COMMUNICATION SYSTEMS  
[Open Elective- I]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Study the fundamental concepts of the analog communication system.*
2. *Analyze various analog modulation and demodulation techniques.*
3. *Students to be able to understand, analyze, and design fundamental digital communication systems.*
4. *Course focuses on developing digital communication systems*
5. *Understand basics of various Communications.*

**COURSE OUTCOMES**

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

1. *Demonstrate knowledge in elements of Analog Digital and Wireless Communication Systems.*
2. *Analyze the analog modulated and demodulated systems.*
3. *Understand the principle involved in different modulation techniques.*
4. *Understand the basic principles of baseband and pass band digital modulation schemes.*
5. *Analyze probability of error performance of digital systems and are able to design digital communications.*
6. *Implement various Keying and accessing techniques in real time wireless communication systems.*

**UNIT- I**

**Communication:** Introduction, Elements of communication systems, wired Communications systems, Wireless Communications systems, Modulation, Need of modulation, modulation Methods, difference between Analog and Digital communication.

**Amplitude Modulation & Demodulation:** DSB-FC(AM)modulation& its demodulation, Double sideband suppressed carrier (DSB-SC) modulation & its demodulation, Single sideband (SSB) transmission, Comparison of various amplitude modulation techniques.

**UNIT- II**

**Angle Modulation & Demodulation:** Generalized concept of angle modulation, Bandwidth of angle modulated waves – Narrow band frequency modulation (NBFM) and Wide band FM (WBFM), Phase modulation (PM).

**UNIT- III**

**Noise in Communication Systems:** Types of noise, Noise figure.

**Analog pulse modulation schemes:** Pulse amplitude modulation (PAM), Pulse Width modulation (PWM) and Pulse Position modulations (PPM).



**UNIT IV**

**Digital Communication:** Introduction-Elements of digital communication systems, sampling process, quantization, quantization noise.

**Source Coding Systems:** Pulse-Code Modulation (PCM), Differential PCM (DPCM), Delta modulation (DM), Comparison of PCM, DPCM, DM.

**Pass band Data Transmission:** Introduction, Amplitude shift keying (ASK), binary phase shift keying (BPSK), Binary Frequency shift keying (BFSK) Comparison of ASK, PSK,FSK.

**UNIT V**

**Introduction to Wireless Communication Systems:** Evolution of Mobile Radio Communication Systems, Examples of wireless communication Systems – Paging Systems, Cordless Telephone, Cellular Telephone Systems, Overview of generation of cellular systems.

**Multiple Access Techniques for Wireless Communications:** Introduction to Multiple Access, FDMA, TDMA, CDMA, SDMA.

**TEXT BOOKS**

- 1.Simon Haykin, *Communication Systems*, Wiley India Edition, 4<sup>th</sup> Edition,2006.
- 2.B.P. Lathi, &Zhi Ding, *Modern Digital & Analog Communication Systems*, Oxford University Press, International, 4<sup>th</sup>Edition,2009.

**REFERENCES**

1. Sam Shanmugam, *Digital and Analog Communication Systems*, John Wiley,2005.
2. Bruce Carlson, & Paul B. Crilly, *Communication Systems – An Introduction to Signals & Noise in Electrical Communication*, McGraw-Hill, 5<sup>th</sup> Edition,2010
3. Bernard Sklar, *Digital Communications*, Prentice-Hall PTR, 2<sup>nd</sup> Edition,2001.
4. Herbert Taub& Donald L Schilling, *Principles of Communication Systems*, Tata McGraw-Hill, 3<sup>rd</sup> Edition,2009.
5. J.G.Proakis, M Salehi, Gerhard Bauch,*Modern Communication Systems Using MATLAB*, CENGAGE, 3<sup>rd</sup> Edition,2013.

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**(19CS0550) RELATIONAL DATABASE MANAGEMENT SYSTEM  
[Open Elective- I]**

**COURSE OBJECTIVES**

The objectives of this course is to

- 1. Explain different issues involved in the design and implementation of a database system.*
- 2. Explain physical and logical database designs, database modeling, relational, hierarchical, and network models.*
- 3. Introduce data manipulation language to, update, and query and manage database.*
- 4. Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling and designing a DBMS.*

**COURSE OUTCOMES**

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

- 1. Develop relational algebra expressions for queries and optimize them.*
- 2. Design the databases using E\_R method for a given specification of requirements.*
- 3. Apply Normalization techniques on given database.*
- 4. Determine the transaction atomicity, consistency, isolation, and durability for a given Transaction-processing system.*
- 5. Implement the isolation property, including locking, time stamping based on Concurrency Control and Serializability of scheduling.*
- 6. Understand Physical Storage Media and RAID concepts*

**UNIT- I**

**Introduction:** Database System Applications, Purpose of Database Systems, View of Data, Data Abstraction, Data Independence, Data Models, Database Languages, Database Architecture, Database Users and Administrators.

**UNIT-II**

**Introduction to Data base design:** ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets.

**Relational Algebra and Calculus:** Relational Algebra - Selection and Projection, Set operations, Renaming, Joins.

**UNIT-III**

**Form of Basic SQL Query:** Examples of Basic SQL Queries, Introduction to Nested Queries, Correlated Nested Queries, Set - Comparison Operators, Aggregate Operators, NULL values - Comparison using Null values.

**UNIT-IV**

**Introduction to Schema Refinement:** Problems Caused by redundancy, Normal Forms - FIRST, SECOND, THIRD Normal forms.

**Properties of Decompositions:** Lossless join Decomposition, Dependency preserving Decomposition - FOURTH Normal Form, FIFTH Normal form.

**UNIT- V**

**Recoverability:** System Recovery – Media Recovery –Two Phase locking – Deadlock- Detection, Recovery and Prevention.

**Physical Storage and Database Concepts:** Overview of Physical Storage Media and RAID.

**TEXT BOOKS**

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, *Database System Concepts*, Tata McGraw Hill, 6<sup>th</sup> Edition, 2011.
2. Raghurama Krishnan, Johannes Gehrke, *Database Management Systems*, McGrawHill Education, 3<sup>rd</sup> Edition, 2003.

**REFERENCES**

1. J. D. Ullman, *Principles of Database and Knowledge – Base Systems*, Vol 1 Computer Science Press, 6<sup>th</sup> Edition, 1993.
2. Peter Rob & Carlos Coronel, *Database Systems Concepts*, Cengage Learning, 2008.
3. C.J. Date, *An Introduction to Database Systems*, Pearson Education, 2<sup>nd</sup> Edition, 2013.
4. G.K.Gupta, *Database Management Systems*, McGraw Hill India, 5<sup>th</sup> Edition, 2018

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**(19HS0813) MANAGEMENT SCIENCE  
[Open Elective- I]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Understand the basic concepts, principles and processes of management.*
2. *Understanding of the functions, responsibilities of managers.*
3. *Awareness about the latest developments and contemporary issues in the field of management.*

**COURSE OUTCOMES**

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

1. *Utilize appropriate theoretical frameworks to real life business and managerial problems.*
2. *Identify appropriate operational risks and develop appropriate responses to them.*
3. *Apply human resource principles to recruit, select and manage employees to achieve Organizational goals.*
4. *Enact strategy, including contingent plans for the effective management of the organization.*
5. *Identify, plan, and implement the projects and evaluate the performance of the projects.*
6. *Analyze effective application of latest developments to diagnose and solve organizational problems.*

**UNIT I**

**Introduction to Management:** Management-Concept and meaning-Nature-Functions-Management as a science and art and both. Schools of Management thought-Taylor's scientific theory-Henry Fayal's principles- Weber's Ideal Bureaucracy-Eltan Mayo's Human relations-Systems theory-Situational or Contingency theory-Social responsibilities of management.

**Organizational structure and design:** Features of organizational structure-work specialization-Departmentation-Span of control- Centralization and Decentralization.

Organizational designs- Line organization-Line & Staff Organization-Functional Organization-Matrix Organization-Project Organization-Committee form of organization.

**UNIT II**

**Operations Management:** Principles and Types of Plant Layout-Methods of production (Job, batch and Mass Production), Work Study- Statistical Quality Control: C chart, P chart, (simple Problems) Deming's Contribution to quality.

**Material Management:** Objectives-Inventory- Functions, types, inventory classification techniques-EOQ-ABC Analysis-Purchase Procedure and Stores Management.

**Marketing Management:** Concept- Meaning - Nature-Functions of Marketing- Marketing Mix-Channels of distribution - Advertisement and sales promotion- Marketing Strategies based on Product Life Cycle.

### UNIT III

**Human Resources Management (HRM):** HRM- Definition and meaning – nature-Managerial and Operative functions-Evolution of HRM- Human Resource Planning(HRP)-Employee Recruitment-sources of recruitment- employee selection- process and tests in employee selection- Employee training and development- On- the- job and Off- the- job training methods-Performance Appraisal systems- Concept-MethodsofPerformanceAppraisal-Placement-EmployeeInduction-WageandSalary Administration- Objectives-Essentials of Wage and Salary Administration-Job Analysis-Process-Job Evaluation-Employee Grievances-techniques of handling Grievances.

### UNIT IV

**Strategic Management:** Definition& meaning-Setting of Vision- Mission- Goals- Corporate Planning Process- Environmental Scanning-Steps in Strategy Formulation and Implementation-SWOT Analysis. Project Management (PERT/CPM):Network Analysis- Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying Critical Path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (Simple problems).

### UNIT V

**Contemporary Issues in Management:** TheconceptofMIS-MaterialsRequirementPlanning(MRP)-Just-In-Time(JIT)System-Total Quality Management (TQM)- Six Sigma Concept- Supply Chain Management-Enterprise Resource Planning (ERP)- Performance Management- Business Process Outsourcing (BPO), Business Process Re-engineering and Bench Marking -Balanced Score Card-Knowledge Management.

### TEXT BOOKS

- 1.A.R Aryasri: *Management Science*, TMH, 2013.
- 2.Stoner, Freeman, Gilbert, *Management*, Pearson Education, New Delhi,2012.

### REFERENCES

- 1.Kotler Philip & Keller Kevin Lane: *Marketing Management*, PHI, 2013.
- 2.Koontz &Weihrich: *Essentials of Management*, 6<sup>th</sup> Edition, TMH, 2005.
- 3.KanishkaBedi, *Production and Operations Management*, Oxford University press, 2004.
- 4.Memoria & S.V.Gauker, *Personnel Management*, Himalaya, 25<sup>th</sup> Edition, 2005.

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**(19EE0241) BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Enhance the student with knowledge on electrical and electronic equipment's.*
2. *Students can gain practical knowledge about network theorems.*
3. *Enhance the student with practical knowledge about characteristics of BJT.*

**COURSE OUTCOMES**

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

1. *Students will understand all the fundamental components about electrical engineering and electronics engineering.*
2. *Make electrical connections by wires of appropriate ratings.*
3. *Understand the usage of common electrical and electronic measuring instruments.*
4. *Understand the basic characteristics of transformers and electrical machines.*

**PART – A  
ELECTRICAL LAB**

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

**PART –B  
ELECTRONICS LAB**

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

Note: Any 5 experiments from each part are to be performed

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**(19CE0106) STRENGTH OF MATERIALS LAB**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Conduct test on engineering materials.*
2. *Determine the elastic properties such as compression, tension, torsion and modulus of elasticity.*

**COURSE OUTCOMES**

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

1. *Conduct tension test on mild steel bar and plot stress strain curve.*
2. *Conduct compression test on wood, brick and concrete and can calculate their compression test.*
3. *Conduct impact test on metal specimens.*
4. *Find hardness of different materials.*
5. *Determine modulus of elasticity of given material of beam by studying deflection for different loads.*
6. *Determine tensile and torsional strength of mild steel bars and find stiffness of a helical spring.*

**List of Experiments**

1. Bending test on simple support beam by using central load and eccentric load
2. Water absorption and Compression test on brick
3. Compression test on wood
4. Compression test on concrete
5. Shear test on wood
6. Impact test on metal specimen (Izod and Charpy)
7. Compression test on helical spring
8. Tension test on mild steel bar
9. Torsion test on mild steel bar
10. Continuous beam – deflection test
11. Hardness test on metals (Rockwell and Brinell Hardness Number Tests)
12. Verification of Maxwell's Reciprocal theorem on beams

Note: Any 10 Experiments are to be performed

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**(19CE0112) FLUID MECHANICS &HYDRAULIC MACHINERY LAB**

**COURSE OBJECTIVES**

The objectives of this course is to

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

**COURSE OUTCOMES**

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

1. *Calibrate Venturi meter & Orifice meter*
2. *Calculate losses inflows*
3. *Estimate the efficiency of different pumps.*
4. *Study the performance of different turbines.*
5. *Study importance of liquid properties and its methods of determination.*
6. *Calculate forces and pressure due to fluid action under different conditions.*

**List of Experiments**

**Cycle 1:**

1. Verification of Bernoulli's equation.
2. Calibration of Coefficient of discharge for Venturimeter.
3. Calibration of Coefficient of discharge for Orifice meter.
4. Calibration of Friction factor. (Major losses experiment)
5. Determination of loss of head due to sudden contraction (Minor losses experiment)

**Cycle 2:**

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

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



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**(19HS0805) ENVIRONMENTAL SCIENCE**

**COURSE OBJECTIVES**

The objectives of the course is to

1. *Identify environmental problems arising due to engineering and technological activities and the science behind those problems.*
2. *Identify the importance of interlinking of food chains.*
3. *Learn about various attributes of pollution management and waste management practices.*

**COURSE OUTCOMES**

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

1. *Recognize the physical, chemical and biological components of the earth's systems and show how they function.*
2. *Characterize and analyze human impacts on the environment.*
3. *Integrate facts, concepts and methods from multiple disciplines and apply to environmental problems.*
4. *Create informed opinions about how to interact with the environment on both a personal and a social level.*
5. *Perform independent research on human interactions with the environment.*
6. *Recognize the ecological basis for regional and global environmental issues*

**UNIT – I**

**Introduction:** Definition, Scope and Importance-Need for Public Awareness

**Natural Resources:** Classification of resources-Forest resources: Use and over-exploitation, deforestation- Mining, dams and their effects on forests and tribal people – Water resources - Use and over utilization of surface and ground water- Floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources –Energy resources: Renewable and Non- Renewable sources of energy- Solar energy, Hydro electrical energy, Wind energy, Nuclear energy.

**UNIT-II**

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

**UNIT-III**

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

**UNIT-IV**

**Environmental Pollution and Global Environmental Issues:** Natural Disasters: Droughts, Floods, Cyclone, Landslides, Earthquake, Pollution episodes: Air pollution, Water pollution, Land pollution, Noise pollution, Automobile pollution and nuclear pollution –Effects-Global warming, Acid Rain and Ozone layer depletion and controlling measures.

**Global Environmental Issues:** Population Growth, Urbanizations, Land Management, Water and Waste Water Management. Climate change and impacts on human environment, Solid Waste Management: causes, effects and control measures of Municipal solid wastes –E-waste and management, Role of an individual in prevention of pollution – pollution case studies.

#### UNIT-V

**Environmental Legislation, Laws, Policies for Sustainable Development:** Environmental Legislation, Environmental Protection act – Air Prevention and Control of Pollution act–Water Prevention and control of Pollution act– Wildlife protection act – Forest conservation act – Municipal Solid Waste management, International conventions/Protocols : Earth summit, Kyoto protocol and Montreal Protocol. From Unsustainable to sustainable development, Role of NGO's for Sustainable development, Concepts of Green belt development, Role of IT in Environment- Remote Sensing and GIS methods for Sustainable development. Field work- visit to a local area to document environmental assets-river forest grassland/hill, mountain and polluted sites (urban/rural/industrial/Agriculture)- study simple ecosystems (pond/river/hill slopes).

#### TEXT BOOKS

1. A. Kaushik and C.P.Kaushik, *Environmental Sciences*, New age international publishers, 5<sup>th</sup> Edition, 2015.
2. M.Anji Reddy, *Text Book of Environmental Science and Technology*, BS Publications, 2016.

#### REFERENCES

1. Anil Kumar and Arnab Kumar De, *Environmental Studies*, New Age International Publishers, New Delhi, 3<sup>rd</sup> Edition, 2015.
2. R.K.Trivedi, *Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards*", Vol.I and II, Enviro Media, 2016.
3. Dr.K.Mukkanthi, *Environmental Studies*, S.Chand Publishers
4. Rajagopalan.R, *Environmental Studies-From Crisis to Cure*, Oxford University Press, 2005.

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**(19HS0833) NUMERICAL METHODS, PROBABILITY & STATISTICS**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Introduce the tools of differentiation and integration of functions of numerical methods that is used in various techniques dealing engineering problems.*
2. *Develop the essential tool of Probability & Statistics in a comprehensive manner.*
3. *Develop the skill pertinent to the practice of the mathematical concepts including the Student abilities to formulate and modeling the problems, to think creatively and to Synthesize information*

**COURSE OUTCOMES**

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

1. *Develop the mathematical skills of the students in the areas of numerical methods.*
2. *Apply numerical methods to find our solution of algebraic equations using different methods under different conditions, and numerical solution of system of algebraic equations.*
3. *Work out numerical differentiation and integration whenever and wherever routine methods are not applicable.*
4. *A good understanding of the laws of probability axioms and rules.*
5. *Understanding of moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables.*
6. *Calculate and interpret the correlation and Regression between two variables.*

**UNIT I**

**Solution of algebraic and transcendental equations:** Solution of polynomial and transcendental equations: Bisection method, Newton-Raphson method and Regula-Falsi method.

**Interpolation:**

Finite differences, Interpolation using Newton's forward and backward difference formulae.

**UNIT- II**

**Numerical solution of Ordinary differential equations:**

Taylor's series, Euler and Runge- Kutta method of fourth order for solving first and second order equations.

**Numerical integration:**

Trapezoidal rule, Simpson's 1/3rd and 3/8rules.

**UNITIII**

**Basic Statistics:**

Measures of Central tendency, Moments, skewness and Kurtosis.

**Basic Probability:**

Probability spaces, Addition theorem, conditional probability, independence, Multiplication theorem, Baye's theorem.

**UNIT IV****Random variables:**

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

**UNIT V****Probability Distributions and Correlation:**

Binomial, Poisson and Normal - Evaluation of statistical parameters for these three distributions.  
Correlation and regression – Rank correlation.

**TEXT BOOKS**

1. B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 44<sup>th</sup> Edition, 2000.
2. T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham & M.V.S.S.N Prasad, *Probability & Statistics*, S.Chand publications, 2018.

**REFERENCES**

1. E.Rukmangadachari & E.Keshava Reddy, *Engineering mathematics*, volume-III, Pearson Publishers
2. Ramana B.V, *Higher Engineering Mathematics*, Tata McGraw Hill New Delhi, 11<sup>th</sup> Reprint, 2010.
3. K.V.Iyengar, Krishna Gandhi B, Ranganatham S & Prasad M.V.S.S.N, *Engineering Mathematics- III*, S.Chand Publications, 2014.
4. Gupta S.P, *Statistical methods*, S.Chand publications, 2011.

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**(19ME0305) ENGINEERING THERMODYNAMICS  
(Common to MECH & AGE)**

**COURSE OBJECTIVES**

The objectives of the course is to

1. *Know the basic terms of thermodynamics, work and heat interactions, balance of energy between system and its surroundings.*
2. *Understand the fundamental laws of thermodynamics and its applications to various gas process and cycles.*
3. *State and explain the Laws of gas and thermodynamic processes.*
4. *Explain various thermodynamic cycles with the help of P-V and T-S Diagrams.*
5. *Analyze the performance of Rankine Cycle.*
6. *Elucidate various methods of improving cycle performance.*

**COURSE OUTCOMES**

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

1. *State and explain the open and closed systems as well as develop and apply continuity equation for them.*
2. *Describe the Basic concepts of thermodynamics such as temperature, pressure, system, Properties, process, state, cycles and equilibrium.*
3. *Explain the Basic laws of thermodynamics and their applications.*
4. *Interpret the Concepts of enthalpy, entropy and other thermodynamic properties of ideal gas Process.*
5. *Analyze Thermodynamic cycles and behavior of pure substances, usage of steam tables and Mollier chart in solving steam related problems.*
6. *Summarize various types of boilers, their construction, working and their applications.*

**UNIT – I**

**Basic Concepts:** Definitions of system, boundary, surrounding and control volume. Types of Thermodynamic systems, Properties of system-definitions for properties-pressure, volume, temperature, enthalpy, internal energy, Density with their units, Point and Path Functions State, Process and Cycle, Quasi Static Process, Thermodynamic Equilibrium.

**Work & Heat Transfer:** Work transfer, Types of work transfers, Heat transfer, Comparison of Work and Heat transfers.

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

**UNIT – II**

**First Law of Thermodynamics:**

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

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

**UNIT – III**

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

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

**UNIT – IV**

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

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

**UNIT – V**

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

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

**TEXT BOOKS:**

1. P.K Nag, *Engineering Thermodynamics*, Tata Mcgraw Hill Publishers, 5<sup>th</sup> Edition, 2013.
2. Yunus Cengel and Michael Boles, *Thermodynamics: An Engineering Approach*, McgrawHill Education, 8<sup>th</sup> Edition, 2014.

**REFERENCES:**

1. P. Chattopadhyay, *Engineering Thermodynamics*, Oxford University Press, 1<sup>st</sup> Revised Edition, 2011.
2. J.P. Holman, *Thermodynamics*, Mcgraw Hill Book Company, 2<sup>nd</sup> Edition, 1975.
3. Y. V. C. Rao, *An Introduction to Thermodynamics*, Universities press, Revised 1<sup>st</sup> Edition, 2009.

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

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**(19ME0306) MANUFACTURING PROCESSES**

**COURSE OBJECTIVES**

The objective of the course is to

- 1. Understand the conventional manufacturing processes like casting, metal forming.*
- 2. Impart fundamentals of various joining processes like gas welding and Arc welding*
- 3. Know the principles of forging and metal forming processes.*
- 4. Recognize the importance of Powder Metallurgy in steel industry.*
- 5. Describe various characteristics of sheet metal.*
- 6. Understand the principle and manufacturing processes of plastics.*

**COURSE OUTCOMES**

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

- 1. Interpret the pattern making, core making and examine the defects present in casting.*
- 2. Select appropriate Joining Processes to join Work piece.*
- 3. Analyze the suitable Hot, Cold Working, and Rolling processes for specific application.*
- 4. Describe the different sheet metal working processes.*
- 5. Explain the process of plastic moulding in Manufacturing Industries.*
- 6. Categorize and select a suitable manufacturing process for metals and plastics according to their needs and applications.*

**UNIT-I**

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

**UNIT-II**

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

**UNIT-III**

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

**Introduction of Explosive forming**: Magnetic pulse forming, Peen forming, Superplastic forming, Micro forming.

**UNIT-IV**

**Sheet Metal Processes** - Sheet metal characteristics – shearing, bending and drawing operation, Stretch forming operations – Formability of sheet metal, Metal spinning

**Powder Metallurgy** – Introduction - Production of Metallic Powder - Processing methods: Mixing and Blending, Compacting, Sintering – Secondary finishing operations, Advantages and applications.

**UNIT-V**

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

**TEXT BOOKS**

1. S.K. HajraChoudhary and AK Hajra Choudhury, *Elements of workshop Technology*, Volume I and II, Media Promoters and Publishers Private Limited, 2008.
2. P.N. Rao, *Manufacturing Technology Foundry, Forming and Welding*”, McGraw Hill Education, 5<sup>th</sup> Edition, 2018.

**REFERENCES**

1. Serope Kalpakjian, *Manufacturing Engineering and Technology*, Pearson Education, 7<sup>th</sup> Edition, 2018.
2. R.K. Jain, *Production Technology*, Khanna Publishers, 17<sup>th</sup> Edition, 2010.
3. J. T. Black, *DeGarmo's Materials and Processes in Manufacturing, SI Version*, Wiley India Edition, 2017.
4. Rosenthal, *Principles of Metal Castings*, Tata McGrawHill, 2<sup>nd</sup> Edition, 1976. R.K. Rajput, *Manufacturing Technology*, Laxmi Publishers, 1<sup>st</sup> Edition, 2008.



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**(19ME0307) THEORY OF MACHINES  
(Common to MECH & AGE)**

**COURSE OBJECTIVES**

The objectives of the course is to

- 1. Learn the principle of gyroscopic effect, construction and purpose of turning moment diagram.*
- 2. Gain knowledge on working and uses of clutch and Dynamometer.*
- 3. Familiarize with the working principle and application of Governor's.*
- 4. Understand the concept of dynamic balancing in different types of engines.*
- 5. Know the concept of free and forced vibration and their analysis.*

**COURSE OUTCOMES**

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

- 1. Explain the Effect of gyroscopic couple, its reactions and also design flywheel for machinery.*
- 2. Find the uses of clutch and modify its application.*
- 3. Design the Brakes according to applications and need.*
- 4. Design a gyroscope in an optimized size with maximum effort.*
- 5. Interpret how to balance an engine to reduce its vibration and noise.*
- 6. Identify the cause of vibration and calculate it's magnitude to reduce it.*

**UNIT -I**

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

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

**UNIT-II**

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

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

**UNIT-III**

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

**UNIT-IV**

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

**UNIT-V**

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

**TEXT BOOKS:**

1. R.S. Khurmi, *Theory of Machines*, Khanna Publishers, 2003.
2. S. S. Ratan, *Theory of Machines*, Tata McGraw Hill, 3<sup>rd</sup> Edition, 2009.
3. Thomas Bevan, *Theory of Machines*, CBS Publishers, 3<sup>rd</sup> Edition, 2009.

**REFERENCES:**

1. Ghosh A. and Mallick A.K, *Theory of Mechanisms and Machines*, Affiliated East-West Press, 2<sup>nd</sup> Edition, 1988.
2. John Uicker, Gordon Pennock, Joseph Shigley, *Theory of Machines and Mechanisms*, Oxford University Press; 4<sup>th</sup> Edition, 2010.
3. J.S Rao. & R.V Duggipati, *Mechanism and Machine Theory*, New age publishers, 2<sup>nd</sup> Edition 1992.

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**(19CE0143) FUNDAMENTALS OF URBAN PLANNING  
[Open Elective- II]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Understand the concept of balanced town by ensuring that new and existing facilities are complimentary to each other.*
2. *Provide sustainable buildings by considering the environmental, social and economic conditions.*
3. *Create awareness about the traffic management within the town.*

**COURSE OUTCOMES**

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

1. *Recognize issues related to town planning and discuss the objectives, necessity and stages of town planning.*
2. *Summarize importance of zoning, can classify various town planning practices and can conduct surveys for town planning.*
3. *Classify the residential building, list the agencies involved in improving house and review the problems associated with residential housing.*
4. *Discuss the issues associated with slums and recognize the methods to improve condition of slums.*
5. *Interpret norms laid down for public and industrial building and can summarize building bye- laws.*
6. *List and discuss various urban roads and the concepts of traffic management in a town.*

**UNIT – I**

**Introduction to Town Planning:** Objects of town planning - Necessity of town planning - Principles of town planning - Stages of Town Planning - Origin and growth of towns - Development of towns - Modern town planning in India - Socio - Economic aspects of town planning - Selection of site for an ideal town – Cost of town planning.

**UNIT – II**

**Surveys & Planning:** Various types of surveys to be conducted for town planning project - Data to be collected in different types of town planning survey - Types of planning - A brief note on urban, rural and regional planning.

**Zoning:** Definition - Objects and principles of zoning - Advantages of zoning - Special Economic Zone (SEZ) - Maps for zoning.

**UNIT – III**

**Housing:** Classification of residential building as per HUDCO norms - Low Cost Housing - Housing policy - Different types of housing agencies involved in housing - Investment in Housing - Housing Problems in India.

**Slums:** Causes - growth - Characteristics - Effects - Slum clearance and re-housing - Prevention of slum formation - Financial assistance for slum clearance.

**UNIT – IV**

**Public Buildings & Industries:** Classification - Location - Design Principles of public building - Grouping of public buildings - Effects of Industries on towns and cities - Classification of industries – Requirements of an industry - Regulation of their location.

**Building Bye-Laws:** Objectives of bye-laws - Importance of bye-laws - Function of local authority - Responsibility of owner - Applicability of bye-laws - Principles underlying building bye-laws.

**UNIT – V**

**Urban Roads:** Objectives – Requirements - Classification - Types of street systems - Through and bypass roads - Outer and inner ring roads - Expressways -Freeways.

**Traffic Management:** Objectives - Traffic surveys - Traffic congestion - Traffic control - Parking - Road accidents - Traffic capacity of roads - Road intersections - Traffic islands - Roundabouts - Traffic signals - Road signs - Road markings - Street lighting in a town.

**TEXT BOOKS:**

1. Rangwala, *Town Planning*, Charotar Publishing, 30<sup>th</sup> Edition, 2018.
2. G K Hiraskar, *Fundamentals of Town Planning*, Dhanpat Rai Publications, New Delhi, 17<sup>th</sup> Edition, 2018.

**REFERENCES:**

1. Abirbandyopadhyay, *Text book of Town Planning*, Books & Allied (P) Ltd, 2000.
2. Peter Hall and Mark Tewdwr-Jones, *Urban and Regional Planning*, Routledge Publications, 5<sup>th</sup> Edition, 2010.
3. Catanese A J, *Urban Planning*, McGraw Hill Publications, 2<sup>nd</sup> Edition, 2014.

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**(19EE0233) INDUSTRIAL INSTRUMENTATION  
[Open Elective- II]**

**COURSE OBJECTIVES:**

The objectives of this course is to

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

**COURSE OUTCOMES:**

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

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

**UNIT-I**

**Characteristics of Signals and Their Representation**

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

**UNIT-II**

**Data Transmission, Telemetry and Das**

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

**UNIT-III**

**Signal Analyzers, Digital Meters**

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

**UNIT-IV****Transducers**

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

**UNIT-V****Measurement of Non-Electrical Quantities**

Measurement of strain, Gauge Sensitivity, Measurement of Displacement, Velocity, Angular Velocity, Acceleration, Force, Torque, Temperature, Pressure, Flow, Liquid level.

**TEXT BOOKS**

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

**REFERENCES**

1. Dhelfrick and W.D. Cooper, *Modern Electronic Instrumentation and Measurement technique* Pearson/Prentice Hall of India, 1990.
2. H.S. Kalsi, *Electronic Instrumentation* Tata McGraw-Hill, 5<sup>th</sup> Edition, 2010.
3. T.R. Padmanabhan, *Industrial Instrumentation—Principles and Design*, Springer.

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**(19EC0451) ELEMENTS OF EMBEDDED SYSTEMS  
[Open Elective- II]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Understand the fundamental concepts of embedded systems.*
2. *Learn the core of embedded systems.*
3. *Learn to program the open source electronics.*
4. *Understand the principles of Internet of Things (IOT).*
5. *Understand the concepts of Internet of Things (IOT).*

**COURSE OUTCOMES**

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

1. *Differentiate between general computing system and the embedded system; also recognize the classification of embedded systems.*
2. *Enumerate and describe the components of an embedded system.*
3. *Learn about open source electronics platform.*
4. *Program an embedded system by interfacing sensors & actuators.*
5. *Identify the basic building blocks of Internet of Things and characteristics.*
6. *Implement their own ideas in various application areas of embedded systems and IOT.*

**UNIT – I**

**Introduction to Embedded Systems:** Definition –Embedded systems vs General computing systems – History – Classification – Purpose - Major application areas – Characteristics – Architecture of embedded system – CPU, RAM & ROM, timers, clocks, address bus & data bus – overview of design process of embedded systems – programming languages and tools for embedded design.

**UNIT – II**

**Typical Embedded System:** Core of the embedded system– RISC vs CISC design philosophy– Memory – Harvard and Von-Neuman architecture–sensors and actuators– Other system components – reset, brownout protection, oscillator, RTC, Watch dog timer. Embedded firmware.

**UNIT – III**

**Communication:** Communication Interfaces – Onboard (I2C, SPI, UART, 1-wire interface, parallel interface), External (RS-232 & RS-485, USB, IEEE 1394, IrDA, Bluetooth, Wi-Fi, Zig Bee, GPRS).

**UNIT – IV**

**Designing of Embedded Systems With Arduino Microcontrollers:** Introduction to Arduino platform– Overview of Arduino UNO board–ATMega328/P Block diagram–Pin functions– Introduction to Arduino programming –Interfacing & programming sensors –Interfacing & programming actuators Interfacing& programming serial communication devices.

**UNIT – V**

**Introduction to IoT:** Introduction to Internet of Things– reference architecture of IoT– Internet principles – IP addresses, MAC addresses, TCP and UDP ports– Application layer protocols– Data protocols– MQTT, XMPP, CoAP– challenges of IoT, Case studies demonstrating IoT – Home automation, cities, Environment, Agriculture.

**TEXT BOOKS:**

1. Shibu K V, *Introduction to Embedded systems*, Tata McGraw-Hill Education, 1<sup>st</sup>Edition,2009.
2. Raj Kamal, *Embedded systems*, Tata McGraw-Hill Education, 2<sup>nd</sup>Edition,2011.
3. Arshdeep Bahga, Vijay Madisetti, *Internet of Things: A Hands-On Approach*, Universities Press/Orient Black Swan Pvt. Ltd, 1<sup>st</sup>Edition,2015.

**REFERENCES:**

1. <https://store.arduino.cc/arduino-uno-rev3>
2. <https://www.arduino.cc/reference/en/>
3. <https://wso2.com/whitepapers/a-reference-architecture-for-the-internet-of-things/>
4. Adrian McEwen & Hakim Cassimally, *Designing of Internet of Things*, John Wiley and sons Ltd, 1st Edition, 2014.



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**(19CS0551) JAVA PROGRAMMING  
[Open Elective- II]**

**COURSE OBJECTIVES**

The objectives of this course

1. *Introduce standard tools and techniques for software development.*
2. *Understand the object oriented approach for automated software build process.*
3. *Introduce the concepts of AWT framework.*

**COURSE OUTCOMES**

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

1. *Implement simple abstract data types and design abstraction functions.*
2. *Recognize features of object-oriented design such as encapsulation, polymorphism, Inheritance, and composition of systems based on object identity.*
3. *Apply object-oriented design patterns for problem solving.*
4. *Implement Exception handling with synchronization.*
5. *Execute programs on Multithreading and String handling concepts.*
6. *Design applications with an event-driven graphical user interface.*

**UNIT- I**

**The Java Language:** Importance of Java -Programming Paradigms -The History and Evolution of Java -Java Byte Code Introduction of OOP -Abstraction, Encapsulation, Inheritance, Polymorphism-Understanding static -Varargs -Data Types -Type Casting -Java Tokens - Java Statements-Arrays.

**UNIT- II**

**Introducing Classes:** Class Fundamentals -Declaring Objects -Introducing Methods Introduction to Constructors -Garbage Collection-Introducing final -Inheritance - Method Overriding -abstract classes -Packages and Interfaces.

**UNIT- III**

**Exception Handling:** Exception Fundamentals - Exception Types -Uncaught Exceptions - Using try and catch - Nested try Statements -throw -throws –finally -Creating Your Own Exception Subclasses - Chained Exceptions.

**UNIT-IV**

**Multithreaded Programming:** The Java Thread Model -Thread Priorities -The Thread Class and the Runnable Interface - Creating Multiple Threads -Using isAlive( ) and join( ) – Synchronization-String Handling.

**UNIT- V**

**Generics:** A simple Generic Example-General form of Generic class -Generic Interfaces Collection Framework-Collections overview, Collection class, Collection interfaces.

**Introducing the AWT:** Using AWT Controls-Layout Managers -Introducing Swing -Exploring Swing.

**TEXT BOOKS**

1. Herbert Schildt, *The Complete Reference (Fully updated for jdk7)*, Oracle press, 9<sup>th</sup> Edition, 2014.
2. Y Daniel Liang, *Introduction to Java programming*. 2<sup>nd</sup> Edition, Que E&T Series in Programming and Development 1999.

**REFERENCES**

1. Cay S Horstmann, *Core Java Volume-1 Fundamentals*, Prentice Hall, 10<sup>th</sup> Edition, 2015.
2. P.J. Deitel and H.M. Deitel *Java How to Program, Prentice Hall, 10<sup>th</sup> Edition, 2016*
3. Herbert Schildt, *Java: A Beginner's Guide*, 6<sup>th</sup> Edition, Oracle Press, 2014..

**SIDDARTHA INSTITUTE OF SCIENCE AND TECHNOLOGY::PUTTUR  
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**II B.Tech- II Sem**

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**(19HS0814) INTELLECTUAL PROPERTY RIGHTS  
[Open Elective- II]**

**COURSE OBJECTIVES**

The objective of the course is to

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

**COURSE OUTCOMES**

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

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

**UNIT-I**

**Introduction to Intellectual Property**

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

**UNIT-II**

**Trade Marks**

Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, Selecting and evaluating trade mark, trade mark registration processes.

**UNIT-III**

**Law of Copy Rights**

Fundamental of copy right law, originality of material, rights of reproduction, rights to Perform the work publicly, copy right ownership issues, copy right registration, notice of Copy right, international copy right law.

**Law of Patents**

Foundation of patent law, patent searching process, ownership rights and transfer

**UNIT-IV****Trade Secrets**

Trade secret law, determination of trade secret status, liability for misappropriations of trade secrets and protection for submission, trade secret litigation.

**Unfair Competition** Misappropriation right of publicity, false advertising.

**UNIT-V****New Development of Intellectual Property**

New developments in trade mark law; copy right law, patent law, intellectual property audits. International overview on intellectual property, international - trade mark law, copy right law, International patent law and international development in trade secrets law.

**TEXT BOOKS:**

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

**REFERENCES:**

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

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**(19ME0308) FUELS LAB**

**COURSE OBJECTIVES**

The objective of the course is to

1. *Explain the Working principle of boiler.*
2. *Find Flash point with Abel's flash point Equipment.*
3. *Determine flash and Fire point with Cleveland's Equipment.*
4. *Measure viscosity of low viscous fuels /lubricants with Redwood Viscometer-I.*
5. *Measure viscosity of low viscous fuels /lubricants with Redwood Viscometer-II.*
6. *Understand the carbon residue percentage in given fuel.*

**COURSE OUTCOMES**

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

1. *List out the different types of boilers.*
2. *Describe the working of Abel's Flash & Fire point Test.*
3. *Experiment on Cleveland's Flash & Fire point Test.*
4. *Explain the method of finding viscosity using Redwood Viscometer-I.*
5. *Understands about the Redwood Viscometer-II.*
6. *Interpret the method of finding carbon residue percentage in given fuel.*

**List of Experiments:**

1. To Study about the Boilers.
2. Determination the Flash point of given sample fuel by using Abel's Apparatus
3. Determination of Flash & Fire point of given sample fuel by using Cleveland's Flash & Fire Point Equipment.
4. Determination of Viscosity of the given sample fuel/lubricant by using Redwood Viscometer-I.
5. Determination of Viscosity of the given sample fuel/lubricant by using Redwood Viscometer-II.
6. To find the Percentage of Carbon content in given sample of fuel.

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**(19ME0309) MANUFACTURING PROCESSES LAB**

**COURSE OBJECTIVES**

The objective of the course is to

1. *Explain various manufacturing processes involved in moulding and casting.*
2. *Describe Various Metal joining processes in welding process.*
3. *Educate the working principle of Mechanical press.*
4. *Illustrate the moulding techniques in the manufacturing process.*
5. *Connect various electronic circuits in the electronic circuit's boards.*

**COURSE OUTCOMES**

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

1. *Demonstrate Engineering principles on metallurgy and material science in manufacturing Processes.*
2. *Produce metal products using casting method.*
3. *Understand the principle of Arc welding and spot welding and perform the same.*
4. *Produce sheets metals parts using mechanical press like piercing and drawing operation.*
5. *Create plastic materials through injection molding and blow molding process.*
6. *Use Soldering process to join components on Electronic circuit.*

**I. Metal Casting Lab:**

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

**II. Welding Lab:**

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

**III. Mechanical Press Working:**

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

**IV. Processing of Plastics:**

- a) Injection Molding
- b) Blow Molding

**V. Soldering Processing**

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**(19ME0310) COMPUTER AIDED MACHINE DRAWING LAB  
(Common to MECH & AGE)**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Make the student understand and draw the conventional representation of various Materials and Machine components.*
2. *Enable the students to learn and draw various types of thread profiles.*
3. *Familiarize the student in drawing Machine elements such as Bolt, Nut and Keys.*
4. *Develop the imagination and drafting skills of students.*
5. *Impart knowledge in drawing various part and Assembly drawings.*
6. *Know numerous commands used in the modeling software*

**COURSE OUTCOMES**

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

1. *Understand and draw the conventional representation of various materials and machine components.*
2. *Design various thread profiles.*
3. *Explain the step to draw Machine elements such as Bolt, Nut and Keys.*
4. *Design a component with given part drawings.*
5. *Explain the procedure to draw part drawings from a given assembled diagram.*
6. *Know the various commands and tool bars used in CAD software.*

**List of Experiments:**

**1. Exercises on Machine drawing conventions using drafting software.**

- Conventional representation of materials.
- Conventional representation of machine components.

**2. Exercises on Machine drawing thread profiles using drafting software.**

- Types of thread profiles-Square, Metric, ACME, Worm, Buttress.

**3. Exercises on drawing of machine elements using drafting software.**

- Bolted joints-Hexagonal bolt and nut, Square bolt and nut.
- Keys-Saddle key, Sunk key, Woodruff key.

**4. PART DRAWINGS:**

Drawing parts of the following assembled drawings

- Sleeve & Cotter Joint
- Knuckle Joint
- Universal Coupling
- Flange Coupling

**5.ASSEMBLY DRAWINGS:**

Drawing assembled views for the following drawings

- Tool Post
- Eccentric
- Connecting rod
- Screw jack
- Stuffing box

**Software Used: AUTOCAD /CATIA / SOLID EDGE**

**TEXT BOOKS:**

1. K.L.Narayana, P.Kannaiah & K.Venkata Reddy, *Machine Drawing*, New Age International Publishers, 3<sup>rd</sup> Edition, 2008.
2. R.K.Dhawan, *Machine Drawing*, S.Chand Publications, Revised Edition, 2006



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**(19HS0817) ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE**

**COURSE OBJECTIVES**

The objectives of the course is to

1. *Impart basic principles of thought process, reasoning and inference.*
2. *Connect society and nature through sustainability.*
3. *Know Holistic life style of yogic science and wisdom capsules in Sanskrit literature.*
4. *Introduce Indian knowledge system and Indian perspective of modern scientific world-wide.*
5. *Learn the basic principles of Yoga and holistic health care system.*

**COURSE OUTCOMES**

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

1. *Connect up the basic principles of thought process.*
2. *Understand Holistic life style of yogic science and wisdom capsules in Sanskrit literature.*
3. *Analyze the society and nature through sustainability.*
4. *Explain Indian knowledge system and Indian perspective of modern science.*
5. *Use the basic principles of Yoga and holistic health care system.*

**UNIT-I**

- Basic structure of Indian Knowledge System: 4 ved
- 4 Upaved (Ayurved, Dhanurved, GandharvaVed&SthapthyaAdi.,)

**UNIT-II**

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

**UNIT-III**

- Modern Science and Indian KnowledgeSystem
- Yoga and Holistic Healthcare

**UNIT-IV**

- Philosophical Tradition ( Nyaya, ,Sankhya, Yog, Jain &Boudha
- Indian Linguistic Tradition –(Phonology, morphology, syntax and semantics)

**UNIT-V**

- Indian Artistic Tradition - Chitrakala, Vasthukala, Sangeetha, Nruthya  
Sahithya
- Casestudies

**TEXT BOOKS**

1. Sivaramakrishnan (Ed.), *Cultural Heritage of India-course material*, Bharatiya VidyaBhavan, Mumbai. 5<sup>th</sup>Edition, 2014.
2. Swami Jitatmanand, *Modern Physics and Vedant*, Bharatiya VidyaBhavan.
3. Swami Jitatmanand, *Holistic Science and Vedant*, Bharatiya VidyaBhavan.

4. Fritzof Capra, *Tao ofPhysics*.
5. Fritzof Capra, *The Wave oflife*.

## REFERENCES

1. VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International ChinmayFoundation, Velliarnad, Arnakulam.
2. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with VyasaBhashya, VidyanidhiPrakashan, Delhi 2016.
3. RN Jha, Science of Consciousness Psychotherapyand Yoga Practices, VidyanidhPrakashan, Delhi 2016.
4. P B Sharma (English translation), Shodashang Hridayan
5. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya VidyaBhavan, Mumbai. 5th Edition, 2014.
6. S.C. Chaterjee& D.M. Datta, An Introduction to Indian Philosophy, University of Calcutta, 1984.
7. K.S. Subrahmanialyer, Vakyapadiya of Bhartrihari, (Brahma Kanda), DeccanCollege Pune 1965.
8. Panini Shiksha, MotilalBanarasidas
9. V.N. Jha, Language, Thought and Reality, Vasudevasharan AGRAWAL Kala yevamSamskruthi, ShithyaBhavanElahabad, 1952.
10. Pramod Chandra, India Arts, Howard Univ. Press, 1983.
11. Krishna Chaitanya, Arts of India, Abhinav Publications, 1987.
12. R. Nagaswamy, Foundations of Indian Art, Tamil Arts Academy, 2002.

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**(19ME0311) DESIGN OF MACHINE ELEMENTS-I**

**COURSE OBJECTIVES**

The objectives of this course is to

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

**COURSE OUTCOMES**

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

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

**UNIT-I**

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

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

**UNIT-II**

**Design for Fluctuating Loads:** Variable (fatigue) stresses, stress concentration, notch sensitivity, and design for fluctuating stresses fatigue failure, endurance limit, estimation of endurance strength, Goodman's line, Soderberg's line and Gerber's line, Modified Goodman's Line. Design of components for finite and infinite life.

**UNIT-III**

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

**Design of Welded Joints:** Introduction, Advantages and Disadvantages of Welded Joints over Riveted Joints, Axially Loaded Unsymmetrical Welded Sections, Eccentrically Loaded Welded joints.

**UNIT-IV**

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

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

**UNIT-V**

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

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

**TEXT BOOKS**

1. R.S. Kurmi and J.K. Gupta, *Machine Design*, S. Chand Publications, 1<sup>st</sup> Multi colour Edition, 2005.
2. V.B. Bhandari, *Design of Machine Elements*, Tata McGraw Hill Publications, 2<sup>nd</sup> Edition, 2007. [https://www.mhlearnsmart.com/flow/flowswf.html?isbn=9352603427&name=smartbook & product=148767](https://www.mhlearnsmart.com/flow/flowswf.html?isbn=9352603427&name=smartbook&product=148767)

**REFERENCES**

1. Sadhu Singh, *Machine Design*, Khanna Publications, 1<sup>st</sup> Edition, 2019.
2. Joseph E. Shigely, *Mechanical Engineering Design*, Tata McGraw Hill Publications, 5<sup>th</sup> Edition, 2006.
3. Pandya and Shah, *Machine Design*, Tata McGraw Hill Publications, 20<sup>th</sup> Edition, 2015.

**Data Books**

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

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

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**(19ME0312) MACHINE TOOLS**

**COURSE OBJECTIVES**

The objectives of this course is to

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

**COURSE OUTCOMES**

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

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

**UNIT-I**

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

**UNIT-II**

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

**UNIT-III**

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

**Advanced Lathes** - Turret and capstan lathes - Automatic lathes – Classification – Single spindle and multi- spindle automatic lathes - Introduction of CNC lathe.

**UNIT-IV**

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

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

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

**UNIT-V**

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

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

**TEXT BOOKS**

1. B. S. Raghu Vamshi, *Workshop Technology – Vol II*, Dhanpat Rai & Co, 9<sup>th</sup> Edition, 2013.
2. R.K. Jain and S.C. Gupta, *Production Technology*, Khanna Publishers, 17<sup>th</sup> Edition, 2012.
3. S.K. Hajra Chowdary, *Elements of Workshop Technology Vol II*, Media promoters & publishers Pvt. Ltd, 13<sup>th</sup> Edition, 2010.

**REFERENCES**

1. Kalpakzian, *Manufacturing Technology*, Pearson Education India, 5<sup>th</sup> Edition, 2009.
2. Milton C.Shaw, *Metal cutting Principles*, Oxford Second Edition, 2<sup>nd</sup> Edition, 2012.
3. K. L. Narayana, *Production Technology*, IK International Publishing house Pvt Ltd 3<sup>rd</sup> Revised Edition 2014.
4. P.N. Rao, *CAD/CAM-Principles and applications*, TMH, 3<sup>rd</sup> Edition, 2010.

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**(19ME0313) CAD/CAM**

**COURSE OBJECTIVES**

Objective of this course to

1. Gain Knowledge in handling 2-D drafting and 3-D modeling software systems.
2. Understand the basics of synthetic curves representations.
3. Familiarize with manual part programming and know the applications of CNC machines.
4. Learn the application of computer in various aspects in manufacturing viz..Design, proper planning, manufacturing cost, layouts and material handling.
5. Identify the Basic need for integration of CAD and CAM.

**COURSE OUTCOMES**

Upon completion of the course Student can

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

**UNIT I**

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

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

**UNIT II**

**Geometric Modeling**: Various construction methods, wire frame modeling- synthetic curves and their representations, Bezier curve, B-spline curves, rational curves- surface modeling.

**Solid Modeling**: Solid representation- fundamentals-introduction to boundary representations- constructive solid geometry- analytical solid modeling.

**UNIT III**

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

**CNC & Part Programming**: Introduction- Basic components of CNC - Fundamentals-canned cycles-cutter radius compensation, length compensation- computed assisted part programming using APT.

**UNIT IV**

**Group Technology**: Part families, Parts classification and coding, Production flow analysis, Machine cell design – FMS, Introduction, components of FMS, material handling systems, Computer control systems, advantages of FMS.

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

**UNIT V**

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

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

**TEXT BOOKS**

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

**REFERENCES**

1. Radhakrishnan and Subramanian, *CAD/CAM/CIM*, New Age, 3<sup>rd</sup> Edition, 2008.
2. R. Sivasubramaniam, *CAD/CAM Theory and Practice*, TMH Publishers, 2012
3. K. Lalit Narayan, *Computer Aided Design and Manufacturing*, PHI, 2008.



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**(19ME0314) THERMAL ENGINEERING**

**COURSE OBJECTIVES**

The objectives of this course is to

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

**COURSE OUTCOMES**

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

1. *Familiarized with Classification and working of Air Compressors.*
2. *Carryout thermodynamic analysis on Brayton cycle.*
3. *Learns about methods of improving Brayton cycle performance.*
4. *Knows about the Steam nozzles and condensers.*
5. *Understands about Steam turbines, Compounding & its governing.*
6. *Gains brief knowledge on I.C Engines & its performance.*

**UNIT-I**

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

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

**UNIT-II**

**Gas Turbines-** Open and Closed cycle- Brayton Cycle-Thermodynamic Analysis, Problems on Brayton cycle.

**Performance and its improvement-** Regenerative, Intercooled, Reheated cycles and their combinations.

**UNIT-III**

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

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

**UNIT-IV**

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

**UNIT-V**

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

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

**TEXT BOOKS**

1. R. K. Rajput, *Thermal Engineering*, Laxmi Publications, 6<sup>th</sup> Edition, New Delhi, 2010.
2. V. Ganesan, *Internal Combustion Engines*, TMH, 4<sup>th</sup> Edition, 2012.

**REFERENCES**

1. P. W Gill. J.H Smith & E.J Ziurgs, *Fundamentals of I.C Engines*, Oxford& I B H Publication 1990, New Delhi.
2. R. Yadav, *Steam & Gas Turbines*, Central Publishing House, 1996.
3. P. L Ballaney, *Thermal Engineering*, Khanna Publication, 15<sup>th</sup> Edition, 2002.

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**(19CE0129) ELEMENTS OF ROAD TRAFFIC SAFETY  
[Open Elective- III]**

**COURSE OBJECTIVES**

The objectives of this course is to

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

**COURSE OUTCOMES**

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

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

**UNIT – I**

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

**UNIT – II**

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

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

**UNIT – III**

**Traffic Signs:** Importance of Traffic Signs – Need for International Standardization – The Situation in India – General Principals of Traffic Signing – Types of Traffic Signs – Danger Signs (Warning Signs

or Cautionary Signs) – Prohibitory Signs – Mandatory Signs – Informative Signs – Indication Signs – Direction Signs, Advance Direction Signs & Place Identification Signs – Overhead Signs – Route Marker Signs – Location, Height & Maintenance of Traffic Signs

#### UNIT – IV

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

#### UNIT – V

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

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

#### TEXT BOOKS

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

#### REFERENCES

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

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**III B. Tech- I Sem**

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**(19EE0239) SOLAR PHOTOVOLTAIC SYSTEMS  
[Open Elective- III]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Develop a comprehensive technological understanding in solar PV system components*
2. *Provide in-depth understanding of design parameters to help design and simulate the performance of a solar PV power plant*
3. *Pertain knowledge about planning, project implementation and operation of solar PV power generation*

**COURSE OUTCOMES**

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

1. *Understand of renewable and non-renewable sources of energy*
2. *Gain knowledge about working principle of various solar energy systems*
3. *Analyse the solar power PV power generation*
4. *Applying the knowledge on to installation and integration of PV modules for different applications*
5. *Know the operation of different solar collectors in the market*
6. *Understand the solar thermal energy storage systems*

**UNIT-1**

**Introduction**

Sources of renewable energy; global potential for solar electrical energy systems. Solar radiation. Extra terrestrial and terrestrial solar spectrum; clear sky direct-beam radiation; total clear sky insolation on a collecting surface; radiation on the collector in tracking systems; calculation of average monthly insolation from measured data

**UNIT-2**

**PV cells and modules**

Solar Cell and its function, Solar Technologies, Solar Cell Parameters, Efficiency of Solar Cell, Solar PV Module, Rating of Solar PV Module, PV Module Parameters, Efficiency of PV Module, Measuring Module Parameters

**UNIT-3**

**Solar Photovoltaic Module Array**

Connection of PV Module in Series and Parallel, Estimation and Measurement of PV Module Power, Selection of PV Module.

**UNIT-4**

**Solar PV System Design and Integration**

Solar Radiation Energy Measurements, Estimating Energy requirement, Types of Solar PV System, Design methodology for SPV system, Design of Off Grid Solar Power Plant, Case studies of 3KWp Off grid Solar PV Power Plant, Design and Development of Solar Street Light and Solar Lantern, Off Grid Solar power Plant.

**UNIT-5**

**Solar collectors and Solar energy storage**

Different types of solar collectors, Flat plate and concentrated type collectors, Fundamental Terminologies of thermal storage, Sensible heat storage materials, Latent heat storage materials, Solar thermo-chemical energy storage systems, Advantages and disadvantages of solar thermal storage, application of thermal storage

**TEXT BOOKS**

1. Chetansingh solanki *Solar Photovoltaic* PHI, Learning private ltd., New dehli- 2018
2. G.D Rai *Non-conventional Sources of Energy* Khanna Publishers, Delhi, 2012

**REFERENCE BOOKS**

1. Chetan Singh Solanki *Renewable Energy Technologies; A Practical Guide for Beginners* PHI School Books, 2008
2. Kothari D.P. and Signal K.C *Renewable Energy Sources and Emerging Technologies*, New Arrivals – PHI; 2 Edition, 2011

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**III B.Tech- I Sem**

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**(19EC0450) INTRODUCTION TO IOT  
[Open Elective- III]**

**COURSE OBJECTIVES**

The objectives of this course is to

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

**COURSE OUTCOMES**

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

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

**UNIT – I**

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

**UNIT – II**

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

**UNIT – III**

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

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

**UNIT – IV**

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

**UNIT – V**

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

**TEXT BOOKS**

3. Vijay Madiseti – Arshdeep Bahga, *Internet of Things a Hands-on Approach*, Arshdeep Bahga & Vijay Madiseti ,1<sup>st</sup> Edition, 2014.
4. Pethuru Raj and Anupama C. Raman, *The Internet of Things: Enabling Technologies, Platforms, and Use Cases*, CRC Press,1<sup>st</sup> Edition, 2014.

**REFERENCES**

1. Raj Kamal, *Embedded Systems*, Tata Mc Graw-Hill Education, 2<sup>nd</sup> Edition, 2011.
2. Adrian McEwen & Hakim Cassimally, *Designing of Internet of Things*, John Wiley and sons Ltd, 1<sup>st</sup> Edition, 2014,
3. Daniel Kellmerit - Daniel Obodovski, *The Silent Intelligence: The Internet of Things*, DnD Ventures, 1<sup>st</sup> Edition, 2013.



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**III B.Tech- I Sem**

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**(19CS0545) SOFTWARE DEVELOPMENT & TESTING  
[Open Elective- III]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Illustrate the Software Development Models*
2. *Explain Software Requirements Engineering Process and SRS document*
3. *Illustrate the importance of modeling and modeling languages*
4. *Explain various testing methodologies*
5. *Explain Quality assurance and test cases*

**COURSE OUTCOMES**

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

1. *Define and develop as software project from requirement gathering to implementation*
2. *Ability to code and test the software*
3. *Ability to plan, estimate and maintain software systems*
4. *Understand the basic testing procedures*
5. *Able to generate test cases and test suites.*
6. *Test the applications manually by applying different testing methods and automation tools.*

**UNIT-I**

**Introduction:** Introduction to Software Engineering , Software Process, Software Myths, A generic view of process, A layered Technology, A Process Framework, Software Process Models, Unified process

**Introduction to Agility:** Agility, Agile Process, Agile Process Models

**UNIT-II**

**Requirements Analysis and Specification:** Requirements Engineering, Eliciting Requirements, Requirements Analysis, Types of Requirements, Requirement Modeling and Data Modeling, Concepts.

**Architectural Design Concepts:** The Design Process, Design Concepts, Design Model, Software Architecture, Architecture Styles.

**UNIT-III**

**User Interface Design:** The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps.

**Web App Design:** Introduction, Web App Interface Design, Aesthetic Design, Content Design, Architecture Design, Navigation Design, Component-Level Design.

**UNIT-IV**

**Software Testing:** Introduction, Levels of Software Testing – Unit Testing, Module Testing, Integration Testing, System Testing, Acceptance Testing, Alpha Testing, Beta Testing,

**Approach to Software Testing:** Types of Software Testing - Black Box Testing, White Box Testing, Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Art of Debugging.

**UNIT-V**

**Software Quality:** Software Testing Life Cycle, Software Quality, Testing Principles, Test Process – Testing Activities, Quality Assurance.

**Software Test Cases:** Introduction to Test cases, Test Case Selection – Test Planning and Design – Test Execution – Case Study on Test tools and automation.

**TEXT BOOKS**

1. Roger S.Pressman, *Software Engineering- A practitioner's Approach*, McGraw-Hill International Edition, seventh edition, 2001.
2. Software Testing techniques, Boris Beizer, Dreamtech, Second Edition

**REFERENCES**

1. Ian Sommerville, *Software Engineering*, 8th Edition, Pearson Education, 2008.
2. Richard Fairley, *Software Engineering Concepts*, McGraw Hill, 2004.
3. Dr.K.V.K.K.Prasad, *Software Testing Tools*, Dreamtech

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**(19HS0861) BUSINESS ETHICS  
[Open Elective- III]**

**COURSE OBJECTIVES**

The objectives of this course is to

- 1. Provide basic knowledge of business ethics, personal ethics and values in modern context*
- 2. Learn and develop best ethical practices in management disciplines to become good managers*
- 3. Make them learn role of corporate culture and corporate governance*

**COURSE OUTCOMES**

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

- 1. Apply various ethical principles in business and corporate social responsibility practices*
- 2. Recognize how personal ethics can influence behavior and apply in decision making*
- 3. Explain the ethical challenges facing the various functional departments*
- 4. Identify the organizational and cultural variables that impact ethical judgment*
- 5. Analyze various ethical codes in corporate governance*
- 6. Identify organizational policies and systems that employ ethical conduct*

**UNIT - I**

**BUSINESS ETHICS:** Introduction – Meaning - Scope – Types of Ethics – Characteristics – Factors influencing Business Ethics – Importance of Business Ethics - Arguments for and against business ethics- Basics of business ethics - Corporate Social Responsibility – Issues of Management – Crisis Management

**UNIT - II**

**PERSONAL ETHICS:** Introduction – Meaning – Emotional Honesty – Virtue of humility – Promote happiness – karma yoga – proactive – flexibility and purity of mind.

**UNIT - III**

**ETHICS IN MANAGEMENT - I**

Introduction – Ethics in HRM – Ethics in HRM: Selection, Training and Development – Ethics at work place – Ethics in performance appraisal - Marketing Ethics –Technology Ethics and Professional ethics.

**UNIT - IV**

**ETHICS IN MANAGEMENT – II:** Ethics in Finance: Insider trading - ethical investment - Ethical issues in Information Technology: Information Security and Threats – Intellectual Property Rights – Cyber crime

**UNIT – V**

**ROLE OF CORPORATE CULTURE IN BUSINESS:** Meaning – Functions – Impact of corporate culture – cross cultural issues in ethics - Modern Ethical Models for Decision Making, Ethics for manager, ethics in business competition

**TEXT BOOKS:**

1. Murthy CSV: Business Ethics and Corporate Governance, HPH, 2007
2. Dr. K. Nirmala, Karunakara Reddy : Business Ethics and Corporate Governance, HPH

**REFERENCES**

1. M.G. Velasquez, *Business Ethics*, Prentice Hall India Limited, New Delhi, 7<sup>TH</sup> Edition, 2012
2. Dr. K. Nirmala, Karunakara Reddy : Business Ethics and Corporate Governance, HPH
3. K. Venkataramana, Corporate Governance, SHBP, 2018

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**III B.Tech- I Sem**

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**(19ME0315) MACHINE TOOLS LAB**

**COURSE OBJECTIVES**

The objective of this course is to

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

**COURSE OUTCOMES**

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

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

**LIST OF EXPERIMENTS**

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

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**(19ME0316) THERMAL ENGINEERING LAB**

**COURSE OBJECTIVES**

Objective of this course is to

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

**COURSE OUTCOMES**

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

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

**List of Experiments**

- 1 (a). Valve Timing Diagram of an I.C. Engine.
- (b). Port Timing Diagram of an I.C. Engine.
2. Performance Test on a 4 -Stroke Diesel Engine.
3. Heat Balance test on a 4 -Stroke Diesel Engine.
4. Performance Test on VCR Petrol Engine.
5. Maintenance of air filter & Carburetor.
6. Experiment on Spark plug cleaning and testing & Chain Overhauling.
7. Experiment on removal of brake & its fitments.
8. Experiment on Engine oil Replacement and Brake overhauling.
9. Study Experiment on Suspension Systems.
10. Experiment on Ultrasonic injector testing & Maintenance.
11. Experiment on Wheel Balancing & Wheel Alignment.
12. Experiment on replacing tire of a four wheeler.
13. Study experiment on Disc Braking.

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**(19ME0317) COMPUTER AIDED MODELING & ANALYSIS LAB**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Impart brief knowledge on CATIA and ANSYS software.*
2. *Familiarize student with various commands used to sketch a part.*
3. *Make the student draw various part drawings using CATIA software and Learn various Assembly commands used ANSYS software to assemble and analysis the component*
4. *Make students understand and learn about the analysis and simulation of simple mechanical parts.*
5. *Develop the student's skills in proper modeling, meshing, and setting up material. Properties, loads, and constraints for computer simulation and analysis.*

**COURSE OUTCOMES**

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

1. *Describe the interface of CATIA software*
2. *Understand the use of different commands in Assembly interface*
3. *Summarize various assembly commands used to assemble the component.*
4. *Varying loads, further to use the available results in ANSYS software*
5. *Demonstrate the deflection of beams subjected to point, uniformly distributed*
6. *Solve problems of bars, truss, beams, plate and to find stress with different loading Conditions.*

**List of Experiments**

1. Introduction to CATIA and ANSYS Software.

**2. MODELLING EXPERIMENTS**

- a) Modeling of Component in 3D–MACHINE ELEMENTS
- b) Modeling of Component in 3D– MACHINE LINK 1
- c) Modeling of Component in 3D– MACHINE LINK 2
- d) Assembly of Component in 3D- KNUCKLE JOINT
- e) Assembly of Component in 3D- SCREW JACK

**3. ANALYSIS EXPERIMENTS**

- a) Introduction to ANSYS
- b) Structural Analysis of a Truss Member
- c) Analysis of Simply Supported Beam
- d) Stress Analysis of Cantilever Beam
- e) Stress Analysis of A Plate With Circular Hole

**Software Used: CATIA/ ANSYS**

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**(19HS0859) ENGLISH FOR CORPORATE COMMUNICATION SKILLS LAB**

**COURSE OBJECTIVES**

The objectives of this course is to

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

**COURSE OUTCOMES**

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

1. *Use fluency in English for all kinds of professional communication*
2. *Enhancing job required skills for getting success in their professions*
3. *Improving Effective Speaking Abilities for their business or professional correspondence*
4. *Prepare effective Interview techniques to get job in the present scenario*
5. *Using the appropriate skills in all kinds of professional activities*
6. *Use effective communicative approaches by preparing job application, report and other kinds of spoken and written correspondences.*

**UNIT I**

**COMMUNICATIVE COMPETENCY**

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

**UNIT II**

**TECHNICAL WRITING**

5. Cover Letter
6. Curriculum vitae
7. Report writing

**UNIT III**

**PRESENTATIONAL SKILLS**

8. Impromptu Speech
9. Oral presentation
10. Power point presentation
11. Poster presentation



**UNIT IV****CORPORATE SKILLS**

12. Problem Solving
13. Team Work
14. Leadership Skills

**UNIT V****GETTING READY FOR JOB**

15. Group Discussion
16. Interview skills

**Minimum requirements for English for Corporate Communication Skills Lab**

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

**System Requirement (Hardware component):**

Computer network, LAN with minimum 60 multimedia systems with the following

**Specifications**

- i)
  - a) Intel(R) core (TM) i3
  - b) Speed 3.10 GHZ
  - c) RAM – 4 GB
  - d) Hard Disk – 320 GB
- ii) Headphones with High quality

**Software**

Walden Info Tech Software

**References**

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

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**(19ME0318) DESIGN OF MACHINE ELEMENTS-II****COURSE OBJECTIVES**

The objective of the course is to

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

**COURSE OUTCOMES**

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

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

**UNIT-I**

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

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

**UNIT-II**

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

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

**UNIT-III**

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

**UNIT-IV**

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

**UNIT-V**

**Design of Gears:** Introduction, Classification of Gears- Spur, Helical, Bevel and Worm Gears.

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

**TEXT BOOKS**

1. R.S. Kurmi and J.K. Gupta, *Machine Design*, S. Chand Publications, 1<sup>st</sup> Multi color Edition, 2005.
2. V.B. Bhandari, *Design of Machine Elements*, Tata McGraw Hill Publications, 2<sup>nd</sup> Edition, 2007.

**REFERENCES**

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

**DATA BOOKS**

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

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

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**(19ME0319) HEAT & MASS TRANSFER**

**COURSE OBJECTIVES**

The Objective of this course to

1. *Elucidate the fundamental mechanisms of heat transfer*
2. *Teach the governing laws of heat transfer by conduction, convection and radiation*
3. *Train the students in using the analytical and empirical methods for estimating heat Transfer under different conditions*
4. *Explicate the rudimentary aspects in heat transfer with phase change.*
5. *Introduce different approaches for solving sizing and rating problems in Heat Exchanger design*

**COURSE OUTCOMES**

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

1. *Explain the fundamental principles associated with heat transfer phenomena and demonstrate their application in a wide range of application areas.*
2. *Develop solutions for transient heat convection in simple geometries Carryout analysis on different types of links, position, velocity, acceleration.*
3. *Obtain numerical solutions for radiation heat transfer problems.*
4. *Understand the fundamentals of heat exchangers.*
5. *Understand the basic laws of Mass transfer.*
6. *Design an appropriate heat exchanger, like condenser, evaporator, radiator etc., for a given heat transfer requirement using LMTD and NTU- $\epsilon$  methods.*

**UNIT I**

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

**UNIT II**

**One Dimensional Steady State Heat Conduction:** Conduction through Plane Wall, Cylinders and Spherical systems – Composite Systems –Critical radius of insulation.

**Extended Surfaces:** Types of Fins, Effectiveness and Efficiency of Fins.

**Transient Heat conduction:** Heat conduction in solids-Lumped Parameter Analysis Infinite, solids with finite, semi-infinite solids.

**UNIT III**

**Convection:** Dimensionless numbers and their physical significance. Classifications of Convection.

**Free Convection:** Empirical correlation of free convection, Flow over Vertical Plate, Horizontal Plate, Inclined Plate, Horizontal cylinders and Spheres.

**Forced Convection:** Laminar flow over a flat plate, Boundary layer definition and characteristics - Empirical correlations for forced convection -External Flow – Flow over Plates - Cylinders Spheres and Bank of tubes.

**UNIT IV**

**Boiling & Condensation:** Types General aspects, Boiling Regimes – Factors affecting nucleate boiling- Boiling correlations. Drop wise and film wise condensation -Laminar film condensation on a vertical plate, correlations in condensation.

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

#### UNIT V

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

**Mass Transfer:** Introduction, Modes of Mass transfer - Fick's law – Mass Transfer coefficient – Convective Mass Transfer and its correlations.

#### TEXT BOOKS

3. Rajput, R. K., *Heat & Mass Transfer*, Laxmi Publications, 3<sup>rd</sup> Edition, New Delhi, 2006.
4. Sachdeva, R.C., *Fundamentals of Heat and Mass Transfer*, 4<sup>th</sup> Edition, New Age International (P) Ltd., New Delhi, 2012.

#### REFERENCES

1. Holman, J.P., *Heat and Mass Transfer*, Tata Mc Graw Hill, 2000.
2. P.K. Nag, *Heat Transfer*, Tata Mc Graw Hill, New Delhi, 2002
5. Frank P. Incropera and David P. Dewitt, *Fundamentals of Heat Mass Transfer*, John Wiley & Sons, 1998
6. Thomas Bevan, *Theory of Machines*, Pearson (P) publisher, 3<sup>rd</sup> Edition, 2009

**NOTE:** Heat transfer Data books are permitted for Examination

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**(19ME0320) METROLOGY & MEASUREMENTS**

**COURSE OBJECTIVES**

The objectives of this course is to

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

**COURSE OUTCOMES**

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

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

**UNIT-I**

**Limits, Fits & Tolerances:** Introduction, Definition of limits and tolerances– unilateral and bilateral tolerance system, Fits and their types, Hole and Shaft basis systems – Interchangeability and selective assembly, Indian standard system– International Standard system for plain work.

**Limit Gauges and Gauge Design:** Plug Ring, Snap, Gap, Taper gauges. Taylor's principle.

**UNIT-II**

**Linear Measurement:** Calibration of Slip gauges, Vernier gauges, Micrometers, Dial indicator.

**Measurement of Angles and Tapers:** Different methods – Bevel protractor – Angle gauges – Spirit level, Clinometer – sine bar, rollers and spheres used to determine the tapers.

**UNIT-III**

**Surface Measurement:** Surface roughness, Surface waviness- Terminology's of surface finish – CLA, R.M.S Values – Ra, Rz values, BIS symbols for indication of surface finish, Talysurf, Auto collimators.

**Screw Thread Measurement:** Elements– Measurement of diameters, angle of thread and thread pitch– Errors In Screw Threads, Toolmaker's microscope.

**Gear Measurement:** Elements -Gear measuring instruments, Gear tooth profile measurement. Measurement of diameter, pitch, tooth thickness.

**UNIT-IV**

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

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

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

#### UNIT-V

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

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

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

#### TEXT BOOKS

1. M. Mahajan, *Engineering Metrology*, DhanpatRai publisher, 2<sup>nd</sup> Edition, 2013.
2. R.K. Jain, *Engineering Metrology*, Khanna Publishers, 20<sup>th</sup> Edition, 2013.

#### REFERENCES

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

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**(19ME0321) NON- CONVENTIONAL ENERGY RESOURCES**

**COURSE OBJECTIVES**

The objective of the course is to

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

**COURSE OUTCOMES**

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

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

**UNIT-I**

**Introduction:** Energy- World Energy use – Classification of Energy's - Reserves of Energy Resources– Environmental Aspects of Energy Utilization

**Renewable energy:** Need Of Renewable Energy – Renewable Energy Scenario in Andhra Pradesh, India and Around the World.

**UNIT-II**

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

**Photo voltaic Conversion:** Fundamentals of Solar Photo Voltaic Conversion – Solar Cells –Solar PV Power Generation – Solar PV Applications, Solar Radiation Measurements

**UNIT-III**

**Wind Energy:** Wind Formation - Site Selection For Wind Turbine - Working Principle of Wind Turbine

**Wind Energy System:** Types of Wind Energy Systems – Performance – Details of Wind Turbine – Wind Energy Measurement, Safety and Environmental Aspects.



**UNIT-IV**

**Bio – Energy:** Biomass direct combustion – Biomass gasifiers – Biogas plants

**Bio Fuel:** Ethanol production – Biodiesel – Cogeneration - Biomass Applications

**UNIT-V**

**Other Sources of Energy:** Tidal energy – Wave Energy – Open and Closed OTEC Cycles, Geothermal Energy

**Hydrogen Fuel:** Hydrogen production and Storage - Fuel Cell Systems – Hybrid Systems.

**TEXT BOOKS**

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

**REFERENCES**

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

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**(19CE0147) PROJECT PLANNING AND CONTROL  
[Open Elective- IV]**

**COURSE OBJECTIVES**

The objective of the course is to

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

**COURSE OUTCOMES**

On successful completion of the course, the student able to

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

**UNIT – I**

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

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

**UNIT – II**

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

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

**UNIT – III**

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

**PERT: Time Computations & Network Analysis:** Earliest expected time – Formulation for  $T_E$  –

Latest allowable occurrence time – Formulation for  $T_L$  – Combined tabular computations for  $T_E$  and  $T_L$  – Slack – Critical path – Probability of meeting scheduled date

#### UNIT – IV

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

#### UNIT – V

**CPM: Cost Model:** Project cost – Indirect project cost – Direct project cost – Slope of direct cost curve – Total project cost and optimum duration – Contracting the network for cost optimization – Steps in time cost optimization

**CPM: Updating:** Updating process – Data required for updating – Steps in the process updating – When to update

**Resources Allocation:** Resources usage profiles: histograms – Resources smoothing – Resources levelling

#### TEXT BOOKS

1. Dr.B.C. Punmia, K.K. Khandelwal, *Project Planning and Control with PERT AND CPM*, Laxmi Publications (P) Ltd., 4<sup>th</sup> Edition, Reprint 2006
2. Dr.P.N. Modi, Sanjeev Modi and Rajeev Modi, *Program Evolution and Review Technique and Critical Path Method*, Standard Book House, 5<sup>th</sup> Edition, 2012

#### REFERENCES

1. L.S. Srinath, *PERT and CPM Principles and Applications*, Affiliated East-West Press (Pvt.) Ltd.
2. S.K. Bhattacharjee, *Fundamentals of PERT/CPM and Project Management*, Khanna Publishers
3. Kumar Neeraj Jha, *Construction Project Management: Theory and Practice*, Pearson, 2 edition, 2015

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**(19EE0231) NEURAL NETWORKS AND FUZZY LOGIC**

**[Open Elective- IV]**

**COURSE OBJECTIVES**

The objectives of this course is to

- 1. Introduce the basics of Neural Networks and essentials of Artificial Neural Networks with Single Layer and Multilayer Feed Forward Networks.*
- 2. Have knowledge on Associate Memories, Fuzzy sets and Fuzzy Logic system components.*
- 3. Know Neural Network and Fuzzy Network system application to Electrical Engineering*

**COURSE OUTCOMES**

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

- 1. Know the basic concept of artificial neural networks*
- 2. Understand different learning mechanism in artificial neural networks*
- 3. Create Neural Network models for electrical engineering.*
- 4. Identify the basic concepts of fuzzy sets.*
- 5. Understand the basic concepts of fuzzy logic.*
- 6. Create Fuzzy models for electrical engineering*

**UNIT - I**

**FUNDAMENTALS OF ARTIFICIAL NEURAL NETWORKS**

Neural networks-introduction, Organization of human brain, Biological neuron, artificial neuron, McCulloch-Pitts neuron model, Characteristics and Applications of artificial neural networks Architectures of artificial neural networks – activation functions, important terminologies of ANN, learning strategies- supervised, unsupervised, reinforced learning.

**UNIT - II**

**SUPERVISED NETWORKS**

Perceptron networks-Perceptron learning, Limitations of Perceptron, back propagation networks-architecture, Computations in each layer, Error calculation in Back propagation networks, Gradient descent method in learning, back propagation algorithm, learning factors - initial weights, learning constant, momentum coefficient, Applications of Neural Networks to Electrical Engineering.

**UNIT - III**

**ASSOCIATIVE MEMORIES**

Introduction, Associative Memories- Auto associative Memory, Bidirectional Associative Memory (BAM), Architectures, Storage and Recall Phases, Recognition of noisy patterns, Hamming distance and Energy functions. Discrete Hopfield network architecture and storage and recall algorithm.

**UNIT - IV**  
**CLASSICAL AND FUZZY SETS**

Introduction to classical sets-properties–Fuzzy vs crisp Fuzzy sets , Membership functions, basic fuzzy set operation, properties of fuzzysets- Fuzzy relations–Fuzzy Cartesian product, operations on fuzzy relations.

**UNIT - V**  
**FUZZY LOGIC SYSTEMS**

Fuzzification–Fuzzy quantifiers, fuzzy inference, fuzzy rule based system-development of rule base and decision making system - Defuzzification to crisp sets-Fuzzification and Defuzzification methods. Applications of Fuzzy logic systems in Electrical Engineering.

**TEXT BOOKS:**

1. S. Rajasekaran, G.A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic, and Genetic Algorithms Synthesis and Applications*, PHI, 2012
2. S.N. Sivanandam, S.N. Deepa, *Principles of Soft computing* WileyIndia private Ltd., 2nd edition, 2013.

**REFERENCES:**

1. Timothy J Ross, *Fuzzy Logic with Engineering Application* , McGraw Hill Inc.1997.
2. Jacek M. Zurada, *Introduction to Artificial Neural Networks*,Jaico Publishing House.
3. Simon Haykin, *Neural Networks - A Comprehensive Foundation*, Prentice- Hall Inc, 1999.

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**(19EC0451) MATLAB PROGRAMMING  
[Open Elective- IV]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Understand the MATLAB Desktop, Command window and the Graph Window*
2. *Be able to do simple and complex calculation using MATLAB*
3. *Understand the mathematical concepts upon which numerical methods*
4. *Understand the tools that are essential in solving engineering problems*

**COURSE OUTCOMES (COs)**

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

1. *Analyze and visualize data effectively by using MATLAB*
2. *Apply numeric techniques and computer simulations to solve engineering-related Problem*
3. *Apply a top-down, modular, and systematic approach to design, write, test, and debug sequential MATLAB programs to achieve computational objectives.*
4. *Design and document computer programs and analyses in a careful and complete manner so as to effectively communicate results, to facilitate evaluation and debugging by another programmer, and to anticipate and resolve user errors.*
5. *Demonstrate understanding and use of fundamental data structures (classes).*
6. *Create and control simple plot and user-interface graphics objects in MATLAB.*

**UNIT-I**

**Introduction to MATLAB:** MATLAB Interactive Sessions, Menus and the toolbar, computing with MATLAB, Script files and the Editor Debugger, MATLAB Help System, Programming in MATLAB.

**UNIT-II**

**Arrays:** Arrays, Multidimensional Arrays, Element by Element Operations, Polynomial Operations Using Arrays, Cell Arrays, Structure Arrays.

**UNIT-III**

**Functions & Files:** Elementary Mathematical Functions, User Defined Functions, Advanced Function Programming, Working with Data Files.

**UNIT-IV**

**Programming Techniques:** Program Design and Development, Relational Operators and Logical Variables, Logical Operators and Functions, Conditional Statements, Loops, the Switch Structure, Debugging MATLAB Programs.

**Plotting:** XY- plotting functions, Subplots and Overlay plots, Special Plot types, Interactive plotting, Function Discovery, Regression, 3-D plots.

**UNIT-V**

**Linear Algebraic Equations:** Elementary Solution Methods, Matrix Methods for Linear Equations, Cramer Method, Undetermined Systems, Order Systems.

**TEXT BOOKS**

1. G. H. Golub and C. F. Van Loan, *Matrix Computations*, 3rd Ed., Johns Hopkins University Press, 1996.
2. B. N. Datta, *Numerical Linear Algebra and Applications*, Brooks/Cole, 1994 (out of print)

**REFERENCES**

1. William J Palm, *Introduction to MATLAB for Engineers*, 3rd edition, Mc GRAW HIL.
2. L. Elden, *Matrix Methods in Data Mining and Pattern Recognition*, SIAM Press, 2007.
3. Amos Gilat, *MATLAB: An Introduction with Applications*, 4<sup>th</sup> edition, WILEY.

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**(19CS0546) INTRODUCTION TO CYBER SECURITY  
[Open Elective- IV]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Understand the fundamentals of cybercrime and the cyber offenses.*
2. *Learn the concepts of cyber threats and cyber security.*
3. *Analyze various cyber threats, attacks, vulnerabilities and mechanisms involved.*
4. *Understand the Tools and Methods Used in Cybercrime.*
5. *Explore the different security policies and practices.*
6. *Design suitable security policies for the given requirements.*

**COURSE OUTCOME**

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

1. *Know fundamentals of cybercrimes.*
2. *Analyze the cyber offenses.*
3. *Realize the cyber threats, attacks, vulnerabilities and its defensive mechanism.*
4. *Understand the Tools and Methods Used in Cybercrime.*
5. *Design suitable security policies for the given requirements.*
6. *Explore the industry practices and tools to be on par with the recent trends.*

**UNIT- I**

**Introduction to Cybercrime:** Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

**UNIT - II**

**Cyber Offenses:** How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

**UNIT - III**

**Cybercrime:** Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones.

**UNIT IV**

**Tools and Methods Used in Cybercrime:** Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.



**UNIT V**

**Cyber Security:** Organizational Implications Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

**TEXT BOOK:**

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.

**REFERENCE BOOK:**

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security , Chwan-Hwa(john) Wu,J.David Irwin.CRC Press T&F Group

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**(19HS0862) STRATEGIC MANAGEMENT  
[Open Elective- IV]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Introduce the basic knowledge of concepts underlying in strategic management, its process*
2. *Provide an insight to the tools and techniques used in analyzing and choosing strategies*
3. *Make them learn the principles of strategy formulation, implementation, evaluation and control of strategy*

**COURSE OUTCOMES**

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

1. *Describe major theoretical concepts, background work and research output in the field of strategic management.*
2. *Develop an understanding of the strategic management process and the functional strategies*
3. *Conduct analysis using various tools and frameworks to make strategic decisions*
4. *Explain the basic concepts, principles and practices associated with strategy formulation and implementation*
5. *Analyze various strategies and explore appropriate strategic implementation at business and corporate levels*
6. *Analyze and evaluate critically real life company situations and develop creative solutions, using a strategic management perspective*

**UNIT I**

**Introduction to Strategic Management** – Definition, significance and components- Strategic Management as a process –Developing a strategic vision, Mission, Objectives, Policies, Environmental Scanning

**UNIT II**

**Strategic Analysis and Choice:** Tools and techniques- Porter's Five Forces Model -BCG Matrix, GE Model, TOWS Matrix, Mc Kinsey 7'S framework - Organisation Analysis – VRIO frame work, Value Chain Analysis.

**UNIT III**

**Strategy Formulation:** - Formulation of strategy at corporate and business level - Strategy Alternatives-Stability Strategy, Growth Strategy, Retrenchment Strategy, and Combination Strategy.

**UNIT IV**

**Strategy Implementation:** Types of Strategies: Offensive strategy, Defensive strategy, vertical

integration, horizontal strategy- Strategy and Leadership - Organization Structure - Resource Allocation as a vital part of strategy - Management of Change

#### UNIT V

**Strategy Evaluation and control** – Establishing strategic controls - Role of the strategist - benchmarking to evaluate performance - strategic information systems – Guidelines for proper control- -strategic audit - Strategy and Corporate Evaluation and feedback in the Indian context.

#### TEXT BOOKS

1. P. SubbaRao, *Strategic Management*, Himalaya,2010
2. Azar Kazmi, *Strategic Management and Business Policy*, Tata McGraw Hill Education, 2009

#### REFERENCES

1. V.S.P. Rao, *Strategic Management – Text and Cases*, Excel books,2009
2. Fred R. David, *Strategic Management A competitive approach Concepts and Cases* , Pearson, 16<sup>th</sup> edition,2019
3. R. Srinivasan, *Strategic Management: the Indian context*, 5<sup>th</sup> edition, PHI,2014
4. N.Chandrasekharan. PS Ananthanarayanan, *Strategic Management*, Oxford publications, 2011
5. Charles L Hill, *Strategic Management an Integrated approach*, Cengage learning, 10<sup>th</sup> edition,2007

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**(19ME0322) HEAT TRANSFER LAB**

**COURSE OBJECTIVES**

The objective of the course is to

1. *Enable the students to do experimentation on heat transfer equipment and gain practical knowledge about heat transfer in thermal systems*
2. *Develop trouble shooting abilities of students for practical heat transfer systems.*
3. *Teach students how to measure heat transfer through various systems*
4. *Understand the various forms of heat transfer and their applications in real life problems.*
5. *Analyze different methods to calculate the heat transfer coefficient in various heat transfer problems*

**COURSE OUTCOMES**

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

1. *Estimate the thermal conductivity of solids and over all heat transfer coefficient of composite systems.*
2. *Estimate the convective heat transfer coefficient co-efficient for various internal and external flow situations.*
3. *Estimate the emission characteristics of a surface for radiation heat transfer.*
4. *Demonstrate the mechanisms of boiling and condensation heat transfer.*
5. *Test practical heat transfer systems like heat exchanger, condenser, evaporator etc.*
6. *Estimate heat transfer coefficients in condensation, boiling and effectiveness of heat pipe.*

**LIST OF EXPERIMENTS**

1. Thermal conductivity of insulating powder material through Concentric Sphere apparatus.
2. Thermal conductivity of insulating material through lagged pipe apparatus
3. Overall heat transfer co-efficient through Composite Slab Apparatus
4. Thermal Conductivity of metal (conductor).
5. Experiment on Transient Heat Conduction
6. Heat transfer coefficient in forced convection.
7. Heat transfer coefficient in natural convection
8. Experiment on Stefan Boltzman Apparatus.
9. Heat transfer in drop and film wise condensation.
10. Experiment on Critical Heat flux apparatus.

**ADDITIONAL EXPERIMENTS**

1. Experiment on Parallel and counter flow heat exchanger.
2. Heat transfer in pin-fin

**NOTE:**

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

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**(19ME0323) METROLOGY AND MEASUREMENTS LAB**

**COURSE OBJECTIVES**

The objectives of this course is to

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

**COURSE OUTCOMES**

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

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

**LIST OF EXPERIMENTS**

1. Calibration of Linear Measuring Instruments
2. Calibration of Angle Using Bevel Protractor & Sine Bar
3. Measurement of Internal Bores
4. Measurement of Surface Roughness
5. Measurement of Thread by Two Wire/ Three Wire Method
6. Measurements of Gear Tooth Dimensions
7. Measurement of Pressure
8. Measurement of Temperature
9. Measurement of Displacement
10. Measurement of Speed

**ADDITIONAL EXPERIMENTS**

11. Measurement of fluid flow
12. Measurement of Vibration

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**(19ME0324) ROBOT PROGRAMMING LAB**

**COURSE OBJECTIVES**

The Objective of this course is to

1. *Provide knowledge on the various robotic systems with the help of mathematical models.*
2. *Distinguish the different types of coordinate systems in the robot.*
3. *Know the different types of drawings on the paper through robot.*
4. *Creating programming structures of Igus programming.*
5. *Using and applying knowledge on various operations by using robot.*

**COURSE OUTCOMES**

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

1. *Describe the characteristics of a robotic system from its dynamic model.*
2. *Identify the different types of coordinate systems in the robot.*
3. *Draw the different types of drawings on the paper through robot.*
4. *Generate programming structures for Igus programming.*
5. *Producing various operations like drilling, welding, pick and place etc., by using robot.*
6. *Making pick and place operations by using robot.*

**LIST OF EXPERIMENTS**

**Part-A: Basic Movements**

1. Moving the robot in different coordinate systems
2. Pick and Place movement
3. Drawing a Square on a Paper
4. Drawing Inner frames on a Paper
5. Writing your name on a Paper
6. Draw a Circle on a Paper
7. Working with programming structures of Igus programming

**Part-B: Industrial Applications**

1. Drilling
2. Fixing a bulb
3. Deburring
4. Cube welding
5. Custom object shape welding
6. Palletizing
7. Pick and Place Matrix operation
8. Robot collaboration

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**(19HS0858) HUMAN VAUES & PROFESSIONAL ETHICS**

**COURSE OBJECTIVES**

The objective of the course is to

1. *Create awareness on Human Values.*
2. *Impart knowledge on an Engineering Ethics*
3. *Instill morality, accountability in an engineering experimentation*
4. *Create awareness on an assessment of safety, risk and rights*
5. *Develop knowledge on global issues*
6. *Create an awareness on Human Values and Engineering Ethics, Engineers social responsibility in an experimentation, appreciate the rights of others and ethics in global issues.*

**COURSE OUTCOMES**

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

1. *Identify and analyze human values in their relevant field*
2. *Assess their own engineering ethics and have the social consciousness*
3. *Get knowledge on codes of ethics and on an utilitarian thinking*
4. *Identify safety, risks and an ethical concern in research and intellectual contexts*
5. *know necessity of computer and an environmental ethics, give a picture on weapons development*
6. *Upon completion of the course, the student should be able to apply the ethics in society, discuss an ethical issues related to engineering and realize the responsibilities and rights in the society*

**UNIT I**

**Human Values** - Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Necessity of Yoga and meditation for professional excellence and stress management.

**UNIT II**

**Engineering Ethics** - Senses of 'Engineering Ethics' – Variety of moral issues – 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

**UNIT III**

**Engineering As Social Experimentation**- Engineering as Experimentation--Engineering Projects VS. Standard Experiments, Engineers as responsible Experimenters--Conscientiousness-Comprehensive Perspective - Moral Autonomy - Accountability, Industrial Standards, Codes of Ethics – A Balanced Outlook on Law.

**UNIT IV**

**Safety, Responsibilities And Rights-** Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk, Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

**UNIT V**

**Global Issues-**Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility

**TEXTBOOKS**

1. R S Nagarajan, *Professional Ethics and Human Values*, New Age International (P) Limited Publishers, 3<sup>rd</sup> Edition, 2006
2. M.Govindarajan, S.Natarajanad, V.S.SenthilKumar, *Engineering Ethics includes Human Values* -PHI Learning Pvt. Ltd- 2<sup>nd</sup> Edition, 2009

**REFERENCES**

1. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, *Engineering Ethics – Concepts and Cases*, Cengage Learning, 2<sup>nd</sup> Edition, 2009
2. John R Boatright, *Ethics and the Conduct of Business*, Pearson Education, New Delhi, 1<sup>st</sup> Edition, 2003
3. Edmund G Seebauer and Robert L Barry, *Fundamentals of Ethics for Scientists and Engineers*, Oxford University Press, Oxford, 4<sup>th</sup> Edition, 2001
4. PSR Murthy, *Indian Culture, Values and Professional Ethics*, BS Publication, 2<sup>nd</sup> Edition, 2013



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**(19ME0325) OPERATION RESEARCH**

**COURSE OBJECTIVES**

Students undergoing this course are able to

1. *Learn about different Research models*
2. *Know about Transportation and Assignment problems*
3. *Develop the best strategy of Game and identifying the Queuing theory.*
4. *Learn about optimum Duration of the Project and critical path method.*
5. *Understand the importance of Replacement models*
6. *Know about sequencing of machines*

**COURSE OUTCOMES**

On successful completion of the course the Students will be able to

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

**UNIT-I**

**Introduction to OR and Linear Programming**–OR definition–Types of Operations Research models; Linear Programming- Problem Formulation, Graphical Method, Simplex Method, Big-M Method (Minimize & Maximize), Degeneracy – Problems.

**UNIT-II**

**Transportation Problem** – Formulation; Initial Basic Feasible Solution-North-West Corner Rule, Least Cost Method, Vogel's Approximation Method, Modified Distribution (MODI) Method, Balanced & Unbalanced Transportation, Maximize profit - Problems

**Assignment Problem** – Formulation, Optimal Solution, Hungarian Assignment method, Traveling Salesman - Problems.

**UNIT-III**

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

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

**UNIT-IV**

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

**UNIT-V**

**Sequencing** –Terminology - Johnson’s Algorithm for n-jobs x 2 Machines and n-jobs x 3 machines models - Problems

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

**TEXT BOOKS:**

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

**REFERENCES BOOKS**

1. M. Mahajan, *Operations Research*, Dhanpat Rai & Co 7<sup>th</sup> edition 2016
2. Er. Premkumar Guptha & Dr.D.S. Hira, *Operations Research*, S. Chand Publications 9<sup>th</sup> edition 2012.
3. R. Panneerselvam, *Operations Research*, PHI, 2<sup>nd</sup> Edition, 2012.
4. ND VORA, *Quantitative Optimization techniques*,

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**(19ME0326) MODERN MACHINING METHODS**

**COURSE OBJECTIVES**

The Objectives of this course is to

1. *Understand the need and importance of non-traditional machining methods and process selection.*
2. *Gain the knowledge to remove material by thermal evaporation, mechanical energy process.*
3. *Apply the knowledge to remove material by chemical and electro chemical methods.*
4. *Analyze various material removal applications by unconventional machining process.*
5. *Know about the Fundamentals of Rapid prototyping and Micro and Nano Fabrication processes*
6. *Provide the knowledge on micro and Nano machining processes*

**COURSE OUTCOMES**

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

1. *Compare non-traditional machining, classification, material applications in material removal process and Summarize the principle and processes of USM, AJM and WJM.*
2. *Understand the principles, processes and applications of EDM, Wire Cut EDM and EDG.*
3. *Identify the principles, processes and applications of CM, ECM, ECG and ECH.*
4. *Understand the principles, processes and applications of EBM and LBM and PAM.*
5. *Know the fundamentals of Rapid Prototyping and its Techniques.*
6. *Understand the fundamentals of Micro and Nano fabrication Techniques.*

**UNIT I**

**Introduction:** Introduction to machining methods– Need – Classification-Difference between Conventional and Non-Conventional machining Processes, Advantages and Disadvantages.

**Modern Mechanical Machining methods:** Ultrasonic Machining, Abrasive Jet Machining, Water Jet Machining-Working Principles – equipment used – Process parameters – MRR- Applications

**UNIT II**

**Thermo Electrical Machining Processes:** Electric discharge machining (EDM)-Working Principle – Equipment's – Process Parameters – MRR – Tool – Power Circuits – Tool Wear – Dielectric – Flushing

**Wire cut EDM:** Working Principle – Advantages and Disadvantages – Applications, Electrical Discharge Grinding (EDG): Working Principle – Equipment – Process Parameters – Applications

**UNIT III**

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

**Electro Chemical Machining Processes:** Electro-Chemical Machining (ECM) - Principles of ECM – equipment's – Surface Roughness and MRR Electrical circuit– Process parameters– Applications. Electro Chemical Grinding (ECG) and Electro Chemical Honing (ECH): Principle– equipment's –Process Parameters – Advantages and disadvantages – Applications

#### UNIT IV

**Thermal Energy Based Modern Machining Processes** – Classification- Electron Beam Machining (EBM), Ion Beam Machining (IBM), Laser Beam Machining (LBM), Principles, Equipment – Types – Applications. Plasma Arc Machining (PAM) - Principles– Equipment – Types- Advantages and disadvantages – Applications

#### UNIT V

**Micro & Nano Machining:** Introduction to Micro fabrication Techniques- Lithography Thin-Film Deposition and Doping, Nanofabrication Techniques-E-Beam Nanofabrication, Scanning Probe Techniques.

#### TEXT BOOKS

1. V.K. Jain, *Advanced Machining Processes*, Allied Publishers Pvt. Ltd, 3<sup>rd</sup> Edition 2016
2. Benedict. G.F, *Non-traditional Manufacturing Processes*, Taylor & Francis, New York, 3<sup>rd</sup> Edition , 2010

#### REFERENCES

1. Pandey. P.C. and Shan H.S, *Modern Machining Processes*, Tata McGraw-Hill, New Delhi, 4<sup>th</sup> Edition 2017
2. Hassan El-Hofy, *Advanced Machining Processes*, McGraw-Hill, New York, 4<sup>th</sup> Edition, 2005
3. <https://www.inup.cense.iisc.ac.in/static/downloads/Introduction-to-Micro-Nanofabrication.pdf>
4. P K Mishra, *Nonconventional Machining*, Narosa Publishing House, 1<sup>st</sup> Edition, 1997.

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**(19ME0327) AUTOMOBILE ENGINEERING**

**COURSE OBJECTIVES**

The objectives of this course is to

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

**COURSE OUTCOMES**

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

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

**UNIT I**

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

**Types of drives:** Types of Automobile Chassis - vehicle chassis, frame and body construction

**UNIT II**

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

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

**Engine cooling system-**Necessity-types

**UNIT III**

**Ignition System:** Need- Battery coil and magnetic coil ignition system,

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

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

**UNIT IV**

**Transmission System:** Clutches-Need-classification-fluid coupling-materials and required properties, propeller shaft. Gearless drives, Electrical vehicles.

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

**UNIT V**

**Steering system:** Steering gears, Types of steering gears, steering Mechanism – Ackerman Steering Mechanism & Davis Steering Mechanism, Suspension System, Rigid Axle Suspension System and Independent Suspension System- shock absorber

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

**TEXT BOOKS**

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

**REFERENCES**

1. Ramalingam K.K, *Internal combustion engines – theory and practice* SciTech Publication India Pvt. Ltd, Chennai, 3<sup>rd</sup> Edition 2000
2. WillamH.crouse, *Automotive Engines* McGraw Hill Publishers, 8<sup>th</sup> Edition 1985
3. R.K. Rajput, *Automobile Engineering*, Laxmi Publications, 1<sup>st</sup> Edition, 2013

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**(19ME0333) GAS DYNAMICS AND JET PROPULSION  
[Professional Elective Course (PEC) – I]**

**COURSE OBJECTIVES**

The objectives of this course is to

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

**COURSE OUTCOMES**

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

1. *Compressible and incompressible flow*
2. *Flow through ducts and variation of flow parameters*
3. *Normal and Oblique shock waves, Prandtl-Meyer relations*
4. *Types of propulsion systems and its performance*
5. *Classification of propellants and combustion chambers*
6. *Applications and Instrumentation used in cryogenics and rockets*

**UNIT I**

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

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

**UNIT II**

**Flow Through Ducts:** Flows through constant area ducts with heat transfer (Rayleigh flow), Momentum Equation, Impulse Function and Friction (Fanno flow) curve

**Variation of flow properties:** Variations of Mach Number with Duct Length, Isothermal Flow with Friction, problems

**UNIT III**

**Normal and Oblique Shocks :** Governing equations – Variation of flow parameters across the normal and oblique shocks and its effect on flow.

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

**UNIT IV**

**Jet Propulsion :**Theory of jet propulsion – Operating principle, cycle analysis, Thrust equation – Thrust power and propulsive efficiency – Operating Principle, cycle analysis, Advanced Propulsion

systems

**COMBUSTORS** – Gas turbine, Ram jet, Supersonic and after burners, Components of Jets and its Efficiencies, Operating parameters

#### UNIT V

**Space Propulsion:** Theory of rocket propulsion- Types of rocket engines and its applications, Engine-Aircraft matching.

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

#### TEXT BOOKS:

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

#### REFERENCES:

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



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**(19ME0334) POWER PLANT ENGINEERING  
[Professional Elective Course (PEC) – I ]**

**COURSE OBJECTIVES**

The objective of this course is to

1. *Illustrate India's power development from various resources, create awareness on power plant economics and pollution control*
2. *Describe thermal power plant, fuel handling equipment as well as combustors for optimum fuel combustion*
3. *Tell about the working of diesel and gas turbine power plants with accessories*
4. *Explain hydrological cycle, classify hydroelectric power plants and their functioning*
5. *Classify nuclear reactors, define their power generating process, and the ways for disposing of radioactive waste.*
6. *Provide knowledge on functioning, economic parameters and environmental effects of power plants*

**COURSE OUTCOMES**

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

1. *Identify India's energy sources, explain power plant economics and environmental issues of various power plants*
2. *Know about working of thermal power plant, fuel handling equipment and explain the need for proper combustion equipment in a thermal power plant*
3. *Describe types of diesel engines and gas turbine power plants, as well as their construction, working principles, and auxiliary equipment.*
4. *Define hydrological cycle, the process of converting water energy into electric power through several types of hydroelectric power plants*
5. *Illustrate various forms of nuclear fuel, its usage in nuclear reactors for power generation and the necessity of careful disposal of nuclear waste*
6. *Summarize energy resources, methods of power generation and environmental protection*

**UNIT I**

**Introduction:** Energy resources and their availability, Types of power plants, Selection of the power plants, Load curve, Connected load, Maximum load, Peak load, Base load, Load factor, Plant capacity factor, Plant use factor, Demand factor, Diversity factor, General arrangement of power distribution system, Power plant Economics- simple Problems

**Power Plant Environmental Considerations:** Effluents from power plants and their impact on environment, Global warming- its effects and control, Methods of pollution control.

**UNIT II**

**Thermal Power Plant:** General Layout of thermal power plant, Working, Site selection, Types of coals, Coal handling equipment, Coal storage, Ash handling systems, Advantages and disadvantages of thermal power plant and its limitations.

**Combustion and Combustors:** Properties of coal, Overfeed and Under feed fuel beds, Travelling grate stokers, Spreader stokers, Pulverized fuel burning system and its Components, Combustion

needs and Draught System, Cyclone furnace, Dust collectors

### UNIT III

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

**Gas Turbine Plant:** Classification, Construction, Layout with auxiliaries, Working principles of Closed and Open cycle gas turbines, Inter cooling, Reheating & Regenerating, Advantages and disadvantages of combined cycle power plants

### UNIT IV

**Hydro Electric Power Plant:** Hydrological cycle, Flow measurement, Drainage area characteristics, Hydrographs, Storage and Pondage, Layout of Hydro electric power plant, Classification of dams

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

### UNIT V

**Nuclear Power Station:** Layout of Nuclear power plant, Working, Nuclear fuel, Nuclear fission, Chain reaction, Breeding and Fertile materials, Nuclear reactor, Reactor operation

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

### TEXT BOOKS

1. P.K. Nag, *Power Plant Engineering*, Tata McGraw Hill Publications, 4<sup>th</sup> Edition, 2014
2. Arora and S. Domkundwar, *A Course in Power Plant Engineering*, Dhanpat Rai & Co Publishers, 6<sup>th</sup> Revised Edition, 2013

### REFERENCES

1. R K Rajput, *A Text Book of Power Plant Engineering*, Laxmi Publications, 5<sup>th</sup> Edition, 2019
2. Sudipta De, *Nag's Power plant Engineering*, McGraw Hill Publishers, 5<sup>th</sup> Edition, 2021
3. P.C. Sharma, *Power plant engineering*, S.K. Kataria Publications, 9<sup>th</sup> Revised 2013, Reprinted 2019
4. G.D. Rai, *An Introduction to Power Plant Technology*, Khanna Publishers, 1987

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**(19ME0335) REFRIGERATION & AIR CONDITIONING  
[Professional Elective Course (PEC) – I]**

**COURSE OBJECTIVES**

The objective of this course is to

1. *Learning the fundamental principles and different methods of refrigeration and air conditioning*
2. *Study of various refrigeration cycles and evaluate performance using Mollier charts and / or refrigerant property tables*
3. *Comparative study of different refrigerants with respect to properties, applications and environmental issues*
4. *Understand the basic air conditioning processes on psychrometric charts, calculate cooling load for its applications in comfort and industrial air conditioning*
5. *Study of the various equipment-operating principles, operating and safety controls employed in refrigeration air conditioning systems*
6. *Students will apply the course knowledge to do a design project of HVAC system*

**COURSE OUTCOMES**

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

1. *Illustrate the fundamental principles and applications of refrigeration and air conditioning system.*
2. *Obtain cooling capacity and coefficient of performance by conducting test on vapour compression refrigeration systems*
3. *Present the properties, applications and environmental issues of different refrigerants*
4. *Calculate cooling load for air conditioning systems used for various*
5. *Operate and analyze the refrigeration and air conditioning systems*
6. *Demonstrate the use of psychrometric in analyzing refrigeration systems*

**UNIT-I**

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

**UNIT-II**

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

**Refrigerants:** Desired properties- Environmental issues- Refrigerant Mixtures.

**UNIT-III**

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

**UNIT-IV**

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

**UNIT-V**

**Air Conditioning Systems and Distribution of Air:** Human comfort, effective temperature & Comfort chart, classifications of Air Conditioning Systems- summer, winter & all year round air conditioning, Window A/C, Split, Crasest A/C, problems.

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

**TEXT BOOKS**

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

**REFERENCES**

1. Roy J. Dossat, *Principles of Refrigeration*, Pearson Education Asia, 4th Edition, 2009.
2. Stoecker, W.F. and Jones J. W., *Refrigeration and Air Conditioning*, McGraw Hill, New Delhi, 5<sup>th</sup> Edition, 1998.
3. R.K Rajput, *A text book of Refrigeration and Air conditioning*, Katson Books, 6<sup>th</sup> Edition, 2013.

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## (19ME0336) FINITE ELEMENT ANALYSIS

[Professional Elective Course (PEC) – II]

**COURSE OBJECTIVES**

The objectives of this course is to

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

**COURSE OUTCOMES**

On successful completion of this course the students will able to

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

**UNIT – I**

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

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

**UNIT – II**

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

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

**UNIT – III**

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

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

**UNIT – IV**

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

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

**UNIT – V**

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

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

**TEXTBOOKS**

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

**REFERENCES**

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

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**(19ME0337) MECHATRONICS & ROBOTICS**

**[Professional Elective Course (PEC) – II]**

**COURSE OBJECTIVES**

The objectives of the course is to

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

**COURSE OUTCOMES**

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

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

**UNIT I**

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

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

**UNIT II**

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

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

**UNIT III**

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

**Introduction to Industrial Robotics:** Need and objectives of robot, Drive systems, Classification of Robot Configurations, functional line diagram, degrees of freedom, Joints, factors to be

considered in the design of grippers- Robot Applications.

#### UNIT IV

**Motion Analysis and Manipulator Kinematics:** Homogeneous transformations, rotation and translation- D-H notation Joint coordinates - Forward and inverse kinematics - manipulator kinematics, Jacobians, Lagrange- Euler and Newton-Euler formulations.

**Trajectory Planning:** Need of path planning, Path planning and avoidance of obstacles, steps in trajectory planning, joint interpolated motion, straight line motion.

#### UNIT V

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

**Robot Applications in Manufacturing:** Material Transfer- Material handling, loading and unloading - Processing - Spot and continuous arc welding, Spray painting, Assembly and Inspection

#### TEXT BOOKS

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

#### REFERENCES

1. HMT, *Mechatronics*, Tata McGraw Hill Publishers, New Delhi
2. Fu K S, *Robotics*, Mc Graw Hill, 4<sup>th</sup> Edition, 2010
3. R.K. Mittal and Nagrath, *Robot and Control System*, Tata McGraw Hill Publishers, 3<sup>rd</sup> Edition, 2005



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**(19ME0338) QUALITY CONTROL & RELIABILITY ENGINEERING  
[Professional Elective Course (PEC) –II]**

**COURSE OBJECTIVES**

The objectives of this course is to

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

**COURSE OUTCOMES**

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

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

**UNIT I**

**Introduction:** Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality Cost-Variation in process causes of variation

**Process Control for Variables:** Theory of control chart- uses of control chart –X chart, R chart and chart - process capability –process capability studies and simple problems. Six sigma concepts

**UNIT II**

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

**UNIT III**

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

**UNIT IV**

**Life testing:** Objective – failure data analysis, mean failure rate, mean time to failure, mean time between failure, hazard rate Maintainability – Factors affecting maintainability of systems – Design for maintainability – MTTR – Maintenance – spare provisioning.

**Reliability:** Wei bull model, system reliability, series, parallel and mixed configuration – simple

problems. Maintainability and availability – simple problems, Acceptance sampling based on reliability test – O.C Curves.

#### UNIT V

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

#### TEXT BOOKS

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

#### REFERENCES

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

Note: Use of approved statistical table permitted in the examination

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**(19ME0339) INDUSTRIAL ENGINEERING & MANAGEMENT  
[Professional Elective Course (PEC) –III]**

**COURSE OBJECTIVES**

The objectives of the course is to

1. *Understand the roles, function, responsibilities & difference among Management, Administration and Organization.*
2. *Acquire knowledge on plant layout & production system*
3. *Understands the basic concepts of work study, work measurements and quality control.*
4. *Know the economics and factors governing the economics of an organisation.*
5. *Recognize the importance of management in supply and purchase*
6. *Undergoing this subject provides brief knowledge on industry functioning mechanisms and factors governing it.*

**COURSE OUTCOMES**

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

1. *Interpret the roles and responsibilities of Management-Administration and Organization.*
2. *Apply concept and evaluate to obtain effective plant setup.*
3. *Estimate the cost of a project taken in to consideration of all factors involves in to also provide solution to improve on existing system*
4. *Improve managerial skills in the economics to compete*
5. *Plan the distribution and collection with the concept of supply chain management*
6. *Understand and grasp the industry setup and easy to involve to their activities.*

**UNIT-I**

**Concepts of Management-Administration and Organization** – Functions of Management, Taylors Scientific Management, Fayol,s Principles of Management, Douglas McGregors Theory X and Y, Hertzbergs Two factor Theory of Motivation, Maslows Hierarchy of Human needs. Functions of Administration.

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

**UNIT-II**

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

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

**UNIT-III**

**Work Study**

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

**Work Measurement** - Definition, Objectives, Work measurement Techniques - Time

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

#### UNIT-IV

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

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

#### UNIT-V

##### **Supply Chain Management**

Supply Chain – Fundamentals, Importance, Decision Phases, Process View. Supplier- Manufacturer –Customer chain, Drivers of Supply Chain Performance. Structuring Supply chain Drivers. Overview of Supply Chain Models and Modeling Systems.

#### TEXT BOOKS

1. O. P. Khanna, *Industrial Engineering and Management*, DhanpatiRai, 18th Edition, 2013.
2. A R. Aryasri, *Managerial Economics and Financial Analysis*, TMH, 2nd Edition, 2018.
3. Sunil Chopra and Peter Meindi, *Supply Chain Management –Strategy Planning and Operation*, Pearson Education, 5<sup>th</sup> Edision, 2013.

#### REFERENCES

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

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**(19ME0340) ADVANCED WELDING PROCESSES  
[Professional Elective Course (PEC) – III]**

**COURSE OBJECTIVES**

The objectives of this course is to

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

**COURSE OUTCOMES**

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

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

**UNIT-I**

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

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

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

**UNIT-II**

**Fusion welding:** Types of fluxes and their compounding wire and strip electrodes. Gas shielded welding TIG and MIG and MAG/ CO<sub>2</sub> Processes. Shielding gases, Current setting, metal transfer and arc length control.

**Plasma welding:** working principle, advantages, disadvantages and its applications.

**UNIT-III**

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

**Laser beam welding:** Laser beam welding setup and operations, Process control and applications.

**UNIT-IV**

**Solid state welding process:** Friction welding - working principle and its types, applications of Friction welding. Introduction of friction stir welding.

**Explosive welding:** Explosive welding and its operations, Diffusion bonding and Adhesive bonding.

**UNIT-V**

**Soldering and brazing:** Soldering mechanism, soldering procedure – brazing, working operation, variant of process, Adhesive bonding: Nature of adhesive joints, Adhesive and classifications, Applications and Safety Precautions.

**Other Welding and cutting Processes:** Pressure welding, solid phase bonding, Ultrasonic welding. Cutting processes- Gas cutting- Oxy fuel cutting

**TEXT BOOKS**

1. Dr. R.S. Parmar, *Welding Processes and Technology*, Khanna Publishers, 3<sup>rd</sup> Edition, 1996
2. Paulo Davim J, *Welding Technology*, Springer Publications, 2<sup>nd</sup> Edition, 2021

**REFERENCES**

1. Jayakumar J. Vora and Vishvesh J. Badheka, P. T, *Advances in Welding Technologies for Process Development*, by CRC Press, Tylor & Francis group, 1<sup>st</sup> Edition, 2020
2. Konigsberger. F, *Welding Technology*, McGraw Hill Publications, 1<sup>st</sup> Edition, 1966
3. Rossi, Boniface E, *Welding Engineering* by PHI, Publications, 1<sup>st</sup> Edition, 1954.

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**(19ME0341) COMPUTER AIDED PROCESS PLANNING  
[Professional Elective Course– III]**

**COURSE OBJECTIVES**

The objectives of this course is to

1. *Understanding the importance of process planning and automation role in manufacturing.*
2. *Classify the various methods of CAPP*
3. *Know the implementation techniques and languages for CAPP.*
4. *Gain knowledge on capacity Planning, shop floor control, MRP.*
5. *Understands about NC, CNC and DNC systems.*
6. *Know about FMS, Adaptive control machining systems.*

**COURSE OUTCOMES**

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

1. *Know the importance of process planning role and automation role in in manufacturing.*
2. *Describe the various methods of CAPP*
3. *Recognize the implementation techniques and languages for CAPP.*
4. *Familiar on capacity planning, shop floor control, MRP.*
5. *Gain knowledge on NC, CNC and DNC systems.*
6. *Familiar in FMS and Adaptive control machining systems.*

**UNIT- I**

**Introduction to Process Planning:** Role of process planning in the manufacturing cycle- Information requirement for process planning system - Conventional process planning vs CAPP.

**Introduction to CAPP:** Automation, basic elements, strategies - Structure of automated process planning system, features recognition - CAPP methods

**UNIT- II**

**Generative CAPP System:** Importance - Generative CAPP system - Automation of logical decisions - Knowledge based systems - Inference Engine, implementation, benefits.

**Retrieval CAPP System:** Significance - Retrieval CAPP system, structure, relative advantages and disadvantages- implementation and applications.

**UNIT- III**

**Implementation Techniques for CAPP:** Group technology, Part family - MIPLAN system - The Bottom-up approach - The Top-Down approach.

**Computer programming languages for CAPP:** Introduction, Programming languages, Criteria for selecting a CAPP system - Benefits of CAPP.

**UNIT- IV**

**Production Planning and Control Systems (PPC):** Capacity planning- shop floor control- MRP-I, MRP-II, ERP and DRP

**Computer Integrated Manufacturing Systems (CIMS):** Introduction to CIMS, CAD/CAM, Scope of CIM, Benefits- Computer controls in NC- NC, CNC and DNC systems.

**UNIT- V**

**Flexible Manufacturing systems (FMS):** Components of FMS, workstation, Material handling system and computer control system, benefits of FMS.

**Adaptive control machining systems:** Introduction to adaptive control machining systems, application- approaches, computer process monitoring and computer process control.

**TEXT BOOKS**

1. Mikel P.Groover *Automation, Production systems and Computer Integrated Manufacturing Systems, Pearson Higher Education, Inc., 4<sup>th</sup> Edition, 2015.*
2. Dr. Sadhu Singh, *Computer Aided Design and Manufacturing*, Khanna Publishers, 2009.

**REFERENCES**

1. Gideon Halevi and Roland D. Weill, *Principles of Process Planning, A logical approach*, Chapman & Hall, 1995.
2. Chang T C and Richard A Wysk, *An Introduction to automated process planning systems*. Prentice Hall, 1985.
3. H.P. Wang and J.K. Li, *Computer Aided Process Planning*, Elsevier Science and Technology Publishers, 1st edition, 1991.