## ENGINEERING SCIENCE COURSES SYLLABUS

| EE 2015: Materials Science | | | |
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| **Teaching Scheme** | | **Examination Scheme** | |
| Lectures | : 2 Hrs/Week | Class Test I | : 15 Marks |
| Tutorial | : --- | Class Test II | : 15 Marks |
| Total Credits | : 2 | Teachers' Assessment | : 10 Marks |
| | | End -Semester Exam | : 60 Marks |

**Pre-Requisites:** NIL

**Course Description:** The purpose of this course is to teach students the fundamentals of Engineering Materials. After completion of this course students will be able to

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| CO1. Apply core concepts in Materials Science to solve engineering problems. |
| CO2. Be knowledgeable of contemporary issues relevant to Materials Science and Engineering. |
| CO3. Select materials for design and construction. |
| CO4. Understand the importance of life-long learning. |
| CO5. Design and conduct experiments, and to analyze data. |

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| **UNIT-I** | Crystal Structure covering, Atomic structure and inter-atomic bonding; Structure ofcrystalline solids; Lattices, unit cells; Crystal systems, Bravais lattices; Indexing of directions andplanes, notations, Inter-planar spacings and angles, co- ordination number, packing factors |
| **UNIT-II** | Defects in Crystals covering, Point defects; Dislocations, Types of dislocations,Burgers vector and its representation; Planar defects, stacking faults, twins, grain boundaries |
| **UNIT-III** | Ceramic Materials covering, Introduction, ceramic structures, silicate structures,processing of ceramics; Properties, glasses; Composite Materials- Introduction, classification,concrete, metal-matrix and ceramic – matrix composites; Electrical & Electronic Properties ofMaterials: Electrical Conductivity, Electronic and Ionic Conductivity, Intrinsic and Extrinsic Semiconductivity, Semiconductor Devices, Dielectric Properties, Piezo-electricity |
| **UNIT-IV** | Mechanical Properties of Materials covering, Concepts of stress and strain, Stress-Strain diagrams; Properties obtained from the Tensile test; Elastic deformation, Plasticdeformation. Impact Properties, Strain rate effects and Impact behaviour. Hardness of materials |
| **UNIT-V** | Magnetic Materials covering, Introduction, Magnetic fields or quantities, types ofmagnetism, classification of magnetic materials, soft magnetic materials, H magnetic materials,, Ferro, Para Magnetic materials; Nano Materials covering, Introduction – Nano materialpreparation, purification, sintering nano particles of Alumina and Zirconia, Silicon carbide, nanoop,nano-magnetic, nano-electronic, and other important nano materials |

**Text Books :**


1. Askeland D.R.,& P. P. Fullay (2007), *The Science and Engineering of Materials –4th* Cengage Learning Publishers
2. William D. Callister, Jr (2008), *Callister"s Materials Science and Engineering*, (Adopted by R. Balasubramaniam) Wiley-Eastern
3. A.S. Edelstein and R.C. Cammarata Ed.(1998), Nano Materials: *Synthesis, Properties and Applications,* Inst. Of Physics Publishing, UK
4. Raghavan V (2007), *Materials Science and Engineering - A First Course*, Prentice Hall, India
5. James F. Shackelford (1996), *Introduction to Materials Science for Engineers,* Prentice Hall, India

**Mapping of Course outcome with Program Outcomes:**

| Course outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PO 13 | PO 14 | PO 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | | | | | | | | | | | | |
| CO2 | 3 | 2 | | | | | | | | | | | | | |
| CO3 | 3 | 1 | | | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | | |
| CO5 | 3 | 1 | | | | | | | | | | | | | |

**1 – Low 2 – Medium 3 - High**

**Teacher's Assessment:** Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Technical quizzes
2) Surprise written test with multiple choice questions
3) Question & answer / Numerical solutions
4) Assignments

| EE2016: Basic Thermodynamics | | | |
|---|---|---|---|
| **Teaching Scheme** | | **Examination Scheme** | |
| Lectures | :2 Hrs/Week | Class Test I | : 15 Marks |
| Tutorial | : --- | Class Test II | : 15 Marks |
| Total Credits | : 2 | Teachers' Assessment | : 10 Marks |
| | | End -Semester Exam | : 60 Marks |

**Pre-requisites:** BS1001 Engineering physics, BS1003 Engineering Chemistry, MA1001 Engineering Mathematics

**Course Description:**

This course consists of basic understanding and application of laws of engineering thermodynamics to the various practical engineering applications like engines, power plants, heat exchangers, pumps etc. Basic understanding of steam formation, steam properties and use of steam tables and Mollier diagram is included in this course. Theoretical analysis of various air standard cycles is covered in this course.

**Course Objectives:**

1. Understand various types of energies and its applications in thermodynamic systems
2. Study various laws of thermodynamics and applications to thermodynamic system
3. Understand steam properties, Interpret steam tables and Mollier charts with numerical applications
4. Understand and analyze (numerical analysis) various types of air standard cycles

**Unit wise Course Outcomes expected:**

After completion of this course students will be able to

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|---|
| **CO1**. Accustom with type of energy and thermodynamic systems |
| **CO2**. Understand Zeroth law First law and second law of thermodynamics |
| **CO3**. Analyse thermodynamic systems by applying laws of thermodynamics |
| **CO4.** Define state of steam and perform steam property calculations |
| **CO5.** Analyse thermodynamic cycle (air standard) performance |

**Detailed Syllabus:**

| | |
|---|---|
| **UNIT-I** | Basic Concepts- Thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work. Zeroth law of thermodynamics, concept of temperature and heat, Concept of ideal and real gases |
| **UNIT-II** | First Law of Thermodynamics- Concepts of Internal Energy, Specific Heat Capacities, Enthalpy. Energy Balance for Closed and Open Systems, Energy Balance for Steady-Flow Systems. Steady-Flow Engineering Devices, reversible and irreversible processes. |
| **UNIT-III** | Second Law of Thermodynamics- Thermal energy reservoirs, Kelvin Plank and Clausius statements of second law, the Carnot cycle, the Carnot Theorem, the thermodynamic temperature scale, Clausius inequality, concept of entropy, isentropic processes, reversible steady-flow work, isentropic efficiencies of steady flow devices - compressor and turbine, second-law efficiency. |

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| **UNIT-IV** | Properties of steam and pure substances:<br>Pure substance, phase, phase transformation of water at constant pressure, p-v phase diagram, critical point, Triple point, Entropy of steam, steam tables, processes of steam, Enthalpy- Entropy diagram, steady flow process and determination of dryness fraction of steam (Numerical Treatment) |
| **UNIT-V** | Power Cycles- Carnot vapour cycle, Rankine cycle, the ideal reheat and regenerative and the second law analysis of vapour power cycles. Gas power cycles, air standard cycle assumptions, an overview of reciprocating engines, Otto cycle, diesel engine cycle, gas-turbine: Brayton cycle, Atkinson cycle |

**Text Books:**


1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi
2. Y. Cengel and Bols, "Thermodynamics – An Engineering Approach" Tata McGraw Hill, New Delhi
3. P L Ballaney, 'Thermal Engineering', Khanna Publishers, Delhi, Twenty Fourth edition, 2005
4. Domkundwar, Kothndaraman, Domkundwar, 'A course in thermal Engineering', DhanapatRai and Co., Delhi, Sixth Edition, Reprint 2012


**Reference Books:**


5. Sonntag, R. E., Borgnakke, C., &Wylen, G. J. V. *Fundamentals of thermodynamics*: Wiley.
6. Moran, M. J., Shapiro, H. N., Boettner, D. D., & Bailey, M. *Fundamentals of Engineering Thermodynamics*: John Wiley & Sons.
7. Jones, J. B., & Dugan, R. E. *Engineering thermodynamics*: Prentice Hall.
8. Potter, M. C., & Somerton, C. W. *Schaum's Outline of Thermodynamics for Engineers,* McGraw-Hill.


**Mapping of Course outcome with Program Outcomes**

| Course outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PO 13 | PO 14 | PO 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | | | | | | | | 1 | 1 | | | | |
| CO2 | 2 | 2 | | | | | | | | 1 | 1 | | | | |
| CO3 | 3 | 3 | 1 | | | 1 | 1 | | 2 | 1 | 1 | 1 | | | |
| CO4 | 3 | 2 | | | | 1 | | | 2 | 1 | 1 | | | | |
| CO5 | 3 | 3 | 1 | | | 1 | 1 | | 2 | 1 | 1 | 1 | | | |

**1 – Low 2 – Medium 3 – High**

**Teacher's Assessment:** Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Technical quizzes
2. Surprise written test with multiple choice questions
3. Question & answer / Numerical solutions
4. Assignments

| EE2017: Solid Mechanics | | | |
|---|---|---|---|
| **Teaching Scheme** | | **Examination Scheme** | |
| Lectures | :2 Hrs/Week | Class Test I | : 15Marks |
| Tutorial | : --- | Class Test II | : 15 Marks |
| Total Credits | : 2 | Teachers' Assessment | : 10 Marks |
| | | End -Semester Exam | : 60 Marks |

**Pre-requisites:**
Fundamental knowledge of Physics, Engineering Mechanics (Static) and Engineering Mathematics

**Course Description:**
The mechanics of deformable solids or strength of materials or solid mechanics or mechanics of materials, as it is commonly called, is one of the core subject that need to be studied by all engineering students. The course builds on the fundamental concepts of engineering mechanics course. Primary aim of this course is to introduce students to the fundamental concepts and principles applied by engineers - whether civil, mechanical, aeronautical, etc. - in the design of structures of all sorts of sizes and purpose. The course content have been presented in five units so that the students can develop the logic and get insight to analyze beams, trusses and solid circular shafts under various actions.

**Course Objectives**:
The objective of this course is to learn the fundamental concepts of stress, strain, and deformation of solids with applications to bars, beams, and columns. Detailed study of engineering properties of materials is also of interest.
The students will:
1. Gain a fundamental understanding of the concepts of stress and strain by analysis of solids and structures
2. Study engineering properties of materials, and stress-strain relationship
3. Learn fundamental concepts of complex stresses and can apply both by analytical and graphical approach to solids and structures
4. Gain a fundamental understanding of the concepts of torsion
5. Learn fundamental concepts of vibrations, understand spring-mass-damper system and undamped and viscously damped systems under harmonic vibration.

**Course Outcomes:** Students successfully completing this course will have a clear and thorough understanding of the fundamental concepts of mechanics of solids and structures and basic analysis and design skills. The students will have the ability to perform stress, strain, and force and deformation analysis by hand. The students will be able to have:
1. Apply the concepts of stress and strain in mechanics of solids and structures and material properties
2. Apply the fundamental concepts of complex stresses the solid and structural mechanics problems
3. Analyze determinate torsional members to determine stresses and strains
4. Physical insight into concepts of vibrations, understand spring-mass-damper system and analyze undamped and viscously damped systems under harmonic vibration

**Detailed Syllabus:**

| | | |
|---|---|---|
| **UNIT-I** | **Simple Stresses and Strains** | **(05 Hrs)** |
| | Concept of normal stress and shear stress, Concept of normal strain and shear strain, Stress and strain diagram, Hooke's law, Generised Hook's Law Elastic constants, Stresses and strains in uniform and varying sections ,under axial loading, concept of thermal stresses and strains. | |

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| **UNIT-II** | **Complex Stresses and Strain** **(05 Hrs)**<br>Stresses on oblique plane, Concept of principal stresses and strains, Analytical and graphical method (Mohr's circle for plane stresses) to determine principal stresses and strains. |
| **UNIT-III** | **Analysis of Statically Determinate Plane Framed Structures** **(05Hrs)**<br>Concept of perfect, Deficient and redundant frames, Analysis of trusses by method of resolution or Method of joints and Method of sections |
| **UNIT-IV** | **Torsion of Prismatic Circular Shafts** **(05Hrs)**<br>Concept of torsion, Torsion formula, Assumptions in the theory of pure torsion, Torsional moment of resistance, Analysis of circular solid and hollow shafts. |
| **UNIT-V** | **Introduction to Machine Vibrations** **(05Hrs)**<br>Causes of machine vibrations, Types of prescribed loadings, Dynamic equilibrium equation using D'Alembert's Principle , Damping force, Mass-spring-damper system, Harmonic vibration of undamped and viscously damped systems. |

**TEXT AND REFERENCE BOOKS**


1. Mechanics of Material by Ferdinand P. Beer and E. Russell Johnston, McGraw Hill, New Delhi.
2. Mechanics of Material by James M. Gere and S.P. Timoshenko, CBS Publishers, New Delhi.
3. Mechanics of Material by William F. Riley, Leroy D. Struges and Don H. Morris: Jhon Wiley & Sons Inc., New York.
4. Introduction to Mechanics of Solids,by E.P. Popov: Prentice Hall of India, New Delhi.
5. An Introduction to Mechanics of Solids by S.H. Crandall, N. C. Dahl and T. V. Lardner:, McGraw Hill International, Tokyo.
6. Dynamics of Structures by R.W. Clough and P.E. Penzien , McGraw-Hill, 1993.
7. Dynamics of Structures by A.K.Chopra , Prentice-Hall of India, 2001.
8. Structural Dynamics by Mario Paz, CBS Publishers, 1987.
9. Structural dynamics by M. Mukhopadhyay, Ane Books India


**Mapping of Course outcome with Program Outcomes :**

| Course Outcome | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PO 13 | PO 14 | PO 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | --- | -- | -- | -- | -- | -- | -- | 1 | -- | 1 | -- | -- | -- |
| CO2 | 3 | 3 | --- | -- | -- | -- | -- | -- | -- | 1 | -- | 1 | -- | -- | -- |
| CO3 | 3 | 3 | --- | -- | -- | -- | -- | -- | -- | 1 | -- | 1 | -- | -- | -- |
| CO4 | 3 | 3 | --- | -- | -- | -- | -- | -- | -- | 1 | -- | 1 | -- | -- | -- |
| CO5 | 3 | 3 | 2 | -- | -- | -- | -- | -- | -- | 1 | -- | -- | -- | --- | -- |

**1 – Low 2 – Medium 3 – High**

**Teacher's Assessment:** Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Technical quizzes
2) Application development
3) Question & answer / Numerical solution
4) Group discussion

| EE 2018: FLUID MECHANICS | | | |
|---|---|---|---|
| **Teaching Scheme** | | **Examination Scheme** | |
| Lectures | : 2 Hrs/Week | Class Test I | : 15 Marks |
| Tutorial | : --- | Class Test II | : 15 Marks |
| Total Credits | : 2 | Teachers' Assessment | : 10 Marks |
| | | End -Semester Exam | : 60 Marks |

**Pre-Requisites:** MA 1001 Engineering Mathematics-1, MA 1002 Engineering Mathematics-II, BS 1001 Engineering Physics

**Course Description:** After completion of the course, students will have understanding of fundamentals of fluid mechanics. They will have knowledge of various hydraulic systems along with applications. They will know the behavior of fluids under static, kinematic and dynamic states. also knowledge about hydraulics turbines and hydraulic pump. They will know impact of Students will acquire skill to be entrepreneur in the field of hydraulic systems.

**Course Objectives:**

1. To study the different types of fluid properties and their determination.
2. To study and analyze the behavior of fluids under static, kinematic and dynamic states.
3. To study and analyze the construction, working and performance of different impulse and reaction turbines.
4. To study and analyze the construction, working and performance of centrifugal pumps.

**Unit wise Course Outcomes expected:**

After completion of this course students will be able to

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| **CO1**. Ability enhancement for the analysis of fluids under static states. |
| **CO 2**. Ability enhancement for the analysis of fluids under kinematic and dynamic states. |
| **CO3**. Ability enhancement for the analysis and performance evaluation of different impulse turbines. |
| **CO4**. Ability enhancement for the analysis and performance evaluation of reaction turbines. |
| **CO5**. Ability enhancement for the analysis and performance evaluation of centrifugal pumps. |

**Detailed Syllabus:**

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| **UNIT-I** | **Fluid Statics**<br>Definitions of fluid & fluid mechanics, properties of fluids like viscosity, surface tension, capillarity etc., types of fluids, Definition of Fluid Statics, pressure in fluids at rest, Pascal's law, manometers, total pressure, center of pressure |
| **UNIT-II** | **Fluid Kinematics & Fluid Dynamics**<br>types of fluid flows, continuity equation in Cartesian and cylindrical co-ordinates,<br>Euler's equation of motion, Bernoulli's equation from Euler's equation, practical applications of Bernoulli's equation. Momentum equation, engineering applications of momentum equation. |

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| **UNIT-III** | **Impulse Turbines**<br>Impact of jet, force of jet impinging on fixed and moving plate, Introduction to turbines, types of turbines. efficiencies of turbines, power produce by an impulse turbines Pelton turbine, design of pelton wheel, governing of pelton wheel. |
| **UNIT-IV** | **Reaction Turbines**<br>Difference between impulse and reaction turbines, classification of reaction turbine, Francis turbine, Kaplan turbine. Components of a reaction turbine, draft tube, types of draft tubes, efficiency of draft tube. |
| **UNIT-V** | **Centrifugal Pumps**<br>Introduction, types of pumps, types of impellers, types of casings, priming, various heads & efficiencies of centrifugal pump, multi-stage pumps. |

**Text Books:**


1. Strength of Materials – R.S.Khurmi, S.Chand and Co, Revised edition, 2007.
2. Mechanics of Materials - Ferdinand P.Beer, E.RusselJhonston Jr., John.T. DEwolf – TMH 2002.
3. Fluid Mechanics - Hydraulics & Hydraulic Machines, Modi& Seth, Standard Publications, New Delhi.
4. Engineering Fluid Mechanics by K. L. Kumar, S.Chand& Co.


**Reference Books:**


1. Strength of Materials Schaum‟s out line series, William Nash – McGraw Hill, 1999.
2. Mechanics of Materials – Dr. B. C. Punmia, Laxmi Publications.
3. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.
4. Fluid Mechanics-Fundamentals & Applications , Yunus A. Cengel& John M Cimbala, McGraw Hill.


**Mapping of Course Outcome with Program Outcome:**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO 9 | PO 10 | PO 11 | PO 12 | PO 13 | PO 14 | PO 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | | | | | | | | | | | | |
| CO3 | 3 | 2 | 1 | | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | | |
| CO5 | 3 | 2 | 1 | | | | | | | | | | | | |

**1- Low 2- Medium 3- High**

**Teachers Assessment:**

Teachers assessment of 10 marks is based on any one of the /or combination of few of the following

1) Assignment based on the above syllabus
2) Question & Answer/ Numerical Solution

| EE 2019: : Engineering Materials | | | |
|---|---|---|---|
| **Teaching Scheme** | | **Examination Scheme** | |
| Lectures | : 2Hrs/Week | Class Test I | : 20 Marks |
| Tutorial | : --- | Teachers' Assessment | : 20 Marks |
| Total Credits | : 2 | End -Semester Exam | : 60 Marks |

**Pre-Requisites:** NIL

**Course Description:** The purpose of this course is to teach students the fundamentals of Engineering Materials.

**Course Objectives:** The objectives of the course are to

1. Know the fundamental science and engineering principles relevant to materials.
2. Understand the relationship between nano/microstructure, characterization, properties and processing and design of materials.
3. Have the experimental and computational skills for a professional career or graduate study in materials.
4. Possess knowledge of the significance of research, the value of continued learning and environmental/social issues surrounding materials.

**Unit wise Course Outcomes expected:**

After completion of this course students will be able to

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|---|
| CO1. Apply core concepts in Materials Science to solve engineering problems. |
| CO2. Be knowledgeable of contemporary issues relevant to Materials Science and Engineering. |
| CO3. Select materials for design and construction. |
| CO4. Understand the importance of life-long learning. |
| CO5. Design and conduct experiments, and to analyze data. |

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| **UNIT-I** | **Conductivity of Metals** : Structure of the Atom, Crystallinity , Anisotropy Factors affecting the resistivity of electrical materials , Motion of an electron in an electric field , Fermi- Dirac distribution , Photo- electric emission, Superconductivity, Electrical conducting materials, Thermoelectric effects, Operation of thermocouple. |
| **UNIT-II** | D**ielectric Properties:** Effect of a dielectric on the behaviour of a capacitor, polarization, Frequency dependence of electronic polarisability, Dielectric losses, Significance of the loss tangent, Dipolar relaxation, Frequency and temperature dependence of the dielectric constant of polar dielectrics, Dielectric properties of polymeric systems, insulating materials, ferroelectricity, piezoelectricity. |
| **UNIT-III** | **Magnetic properties of Materials:** Classification of magnetic materials,The origin of permanent magnetic dipoles, Diamagnetism, Paramagnetism, ferromagnetism, The origin of ferromagnetic dipoles, ferromagnetic domains, the magnetic curve, Magnetization curve, the hysterisis loop, magnetostriction, factors of affecting permeability and hysterisis loss, common magnetic materials, anti-ferromagnetic , ferromagnetic, magnetic resonance |
| **UNIT-IV** | **Semi-conductors**: Energy bands in solids, the Einstein relation, hall effect, electrical conductivity of doped materials, materials for fabrication of semi-conductor devices, **Measurement of electrical and magnetic properties** : conductivity measurements, dielectricmeasurements, magnetic measurements, Measurement of semi-conductor parameters **Conduction in liquids**: faraday's law of electrolysis, ionic velocities, chemical cells andconcentration cells, irreversible and reversible cells, practical cell, electrolytic |

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| | depositions corrosion of metals, nature of corrosion<br>**Optical properties of solids** :photo-emission, photo-emission materials and types of photo-Cathodes, definitions of terms, electroluminescence, electroluminescent panels. |
| **UNIT-V** | **Materials for electric components:** Introduction, resistors, capacitors, inductors, relays<br>**Mechanical properties**: The stress/strain relationship, plastic behaviour, block slip theory, hardening, ductility |

**TEXT BOOKS :**


1. Indulakar," Enginnering Material", S. Chand Publications
2. M F Ashby, David R H Jones, "Enginnering Materials".
3. Mathew Philip, William Bolton, "Technology of Enginnering Materials".
4. J A Charles, F A A Crane, J A G Furness "Selection and use of Enginnering Materials".
5. Joachim, Rosler, Harald, Harders, Martin Baker "Mechanical Behaviour of Engineering Materials"
6. Krishan Kumar Chawla, "Composite Materials: Science & Engineering


**Mapping of Course outcome with program outcomes:**

| Corse Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PO 13 | PO 14 | PO15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | | | | | | | | | | | | |
| CO2 | 3 | 2 | | | | | | | | | | | | | |
| CO3 | 3 | 1 | | | | | | | | | | | | | |
| CO4 | 3 | 2 | 1 | | | | | | | | | | | | |
| CO5 | 3 | 1 | | | | | | | | | | | | | |

**1- LOW 2- MEDIUM 3- HIGH**

**Teaching Strategies:**

The teaching strategy is planed through the lectures, tutorials and team based home works. Exercises are assigned to stimulate the students to actively use and revise the learned concepts which also help the students to express their way of solving the problems fluently in written form. Most critical concepts and mistakes are emphasized.

**Teacher's Assessment:** Teacher's Assessment based on one of the /or combination of the few of the following.

1. Multiple choice question
2. PPT presentation

| EE 2020: Numerical Computational Techniques | | | |
|---|---|---|---|
| **Teaching Scheme** | | **Examination Scheme** | |
| Lectures | : 2 Hrs/Week | Class Test I | : 15 Marks |
| Tutorial | : --- | Class Test II | : 15 Marks |
| Total Credits | : 2 | Teachers' Assessment | : 10 Marks |
| | | End -Semester Exam | : 60 Marks |

**Pre-Requisites:**
MA1001: Engineering Mathematics- I, MA1002:Engineering Mathematics- II
MA2001: Engineering Mathematics-III, EE2004:Computer Programming

**Course Description:** Numerical Computational Techniques is a optional course belongs to Engineering Science course to second year electrical engineering students of the institute in the Semester –IV.

**Course Objectives:**
This course strives to enable students
1. To provide the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology
2. To emphasize the need of computational techniques and analyze errors involved in the computation.
3.To provide an overview of numerical techniques to solve ordinary and partial differential equations, which we apply to solve many engineering problems of electrical , mechanical& civil Engineering.
4. To apply various numerical methods to obtain solution of different types of equations such as transcendental, simultaneous, and also for interpolation, integration and differentiation.

**Course Outcomes Expected:**
After completion of this course students will be able to

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|---|---|
| CO1 | Demonstrate types of errors in computation and their causes of occurrence |
| CO2 | Apply appropriate numerical method for solution ofTranscendental and polynomial equation |
| CO3 | Apply and compare various numerical methods to solve first and second order ODE |
| CO4 | Apply different numerical methods for interpolation, numerical differentiation and integration. |
| CO5 | To demonstrate the applications of numerical computational techniques to engineering problems drawn from industry and other engineering fields. |

**Detailed Syllabus:**

| | |
|---|---|
| **UNIT-I** | **Introduction**<br>Basic principle of numerical methods and necessity of computers for high-speed calculations, representation of numbers and number systems, floating point algebra with normalized floating point technique. Error: types, causes of occurrence and remedies to minimize them. Significant digits and numerical instability in computations **Concept of roots** of an equation and methods to find the same. Methods to solve equations like Bisection, Secant, Regula-False and Newton-Raphson Method, Synthetic division, Birge-Vieta,, Newton-Raphson Methods for complex variable and complex roots |
| **UNIT-II** | **A) Solution of Transcendental and polynomial equation** : Bisection, Secant, Regula-Falsi, Chebyshev and Newton-Raphson methods, NewtonRaphson method for two variables.<br>**B) Curve Fitting** using least square approximation – First order and second order. |

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|---|---|
| **UNIT-III** | **Interpolation:**<br>A) Difference operators, Introduction to interpolation - Newton's forward, backward interpolation formulae, Stirling's and Bessel's central difference formulae, Newton's divided difference formula, Lagrange's interpolation.<br>B) Numerical Differentiation using Newton's forward and backward interpolation formulae |
| **UNIT-IV** | **Solution of Linear algebraic simultaneous equations**: Direct Methods like Crammer's rule, Gauss elimination and Gauss-Jordan method. concept of pivoting – partial and complete. Iterative methods like Gauss, simple Gauss-Seidel and Newton-Raphson Method.<br>**Matrix Inversion** using Jordon method and Eigen values using Power method and Jacobi methods.Introduction to Eigen value and Eigen vectors |
| **UNIT-V** | **Numerical Differentiation and Integration**<br>**Numerical differentiation** using simple interpolation technique like Lagrangian and Newton-Gregory polynomials. Solution of ordinary differential equations using Euler's methods, Nystrom's method, Taylor's series method, Runge-Kutta second and fourth order technique using Hune's and Polygon method. Introduction to simple Predictor-Corrector techniques **Numerical integration** using Trapezoidal, Simpson's rule as a special case of Newton-Cote's quadrature techniques for single and double integrals |

**Text Books:**

1. Numerical Methods for Scientific and Engineering Computations – M. K. Jain / S. R.K.Iyangar / R. K. Jain
2. V Rajaraman., " Computer oriented Numerical Methods", Prentice Hall Publication
3. Fransis Scheid, "Numerical Analysis", Tata McGraw Hill Publication
4. Calculus of Finite Difference and Numerical Analysis – Gupta / Malik.
5. Numerical Methods for Engineers by Steven Chapra, Raymond P. Canale – Tata McGraw Hill Publication.
6. Numerical Methods, second edition, S. Arumugan, A. Thangapandi Isaac, A. Somasundaram, SCITECH Publications (India) Pvt. Ltd.

**Reference Books:**

1. Numerical Mathematical Analysis – J. B. Scarborough.
2. Robert Schilling, Sandra L. Harries, "Applied Numerical Methods for Engineers", Thomson
3. Numerical Methods – E. Balgurusamy - Tata McGraw Hill Publication
4. Numerical Methods with Programs in C and C++ - T. Veerarajan and T. Ramchandran - Tata McGraw Hill Publication.

**Mapping of Course Outcome with Program Outcomes :**

| Course outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PO 13 | PO 14 | PO 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 2 | | | | | | | | | | | | |
| CO2 | 3 | 1 | 2 | | 1 | | | | 1 | 1 | | 1 | | | |
| CO3 | 3 | 1 | 2 | | 1 | | | | 1 | 1 | | 1 | | | |
| CO4 | 3 | 1 | 2 | | 1 | | | | 1 | 1 | | 1 | | | |
| CO5 | 3 | 2 | 1 | | 1 | | | | 1 | 1 | | 1 | | | |

**1- LOW 2- MEDIUM 3- HIGH**

**Teaching Strategies:**

The teaching strategy is planed through the lectures, tutorials and team based home works. Exercises are assigned to stimulate the students to actively use and revise the learned concepts which also help the students to express their way of solving the problems fluently in written form. Most critical concepts and mistakes are emphasized.

**Teacher's Assessment:** Teacher's Assessment based on one of the /or combination of the few of the following.

1. Home Assignments
2. Surprise written Test with multiple choice question