SHARNBASVA UNIVERSITY
DEPT OF PHYSICS
ENGINEERING PHYSICS SYLLABUS

Course Title:	Engineering Physics for CSE stream		
Course Code:	22PHYS12/22	CIE Marks	50
Course Type (Theory/Practical)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L+T)	3	Exam Hours	03
Total Hours of Pedagogy	40 hrs	Credits	03

Course objectives

- To study the essentials of Lasers and Optical fibers for engineering applications.
- To study the principles of quantum mechanics and its application in quantum computing.
- To study the electrical properties of materials especially superconductors.
- To study the essentials of physics for computational aspects like design and data analysis.

Teaching-Learning Process

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes andmake Teaching –Learning more effective

1. Flipped Class
2. Smart Class Room
3. Blended Mode of Learning
4. Interactive Simulations and Animations
5. Assignments based learning
6. NPTEL and Other Videos for theory topics
7. Lab Experiment Videos

Module-1 (8 Hours)

Laser and Optical Fibers:

LASER : Basic properties of a LASER beam, Interaction of Radiation with Matter, Einstein's A and B Coefficients, Laser Action & Numerical Problems, Population Inversion, Metastable State, Requisites of a laser system, Types of Lasers, Semiconductor Diode Laser, Applications: Bar code scanner, Laser Printer, CD writing/reading.

Optical Fiber : Principle and structure, Acceptance angle and Numerical Aperture (NA), Expression for NA (derivation) & Numerical Problems, Types of Optical Fibers, Attenuation and Fiber Losses & Numerical Problems, Applications of Optical Fibers: Local Area Network (LAN) and Fiber Optic Communication.

Pre requisite:Properties of light

Self-learning: Total Internal Reflection & Propagation Mechanism (Optical Fibers)

Module-2 (8 Hours)

Quantum Mechanics:

Inadequacies of Classical Mechanics (Blackbody radiation & Photo electric effect), de Broglie Hypothesis and Matter Waves, de Broglie wavelength, Heisenberg's Uncertainty Principle and its application (Non existence of electron insidethe nucleus-Non Relativistic) & Numerical Problems, Wave Function, Physical Significance of a wave function, Time independent Schrodinger wave equation, Eigen functions and Eigen Values, Motion of a particle in a one dimensional potential well of infinite depth.

Pre requisite:Wave–Particle dualism;

Self-learning: de Broglie Hypothesis

Module-3 (8 Hours)

Electrical Conductivity in metals :

Electrical Conductivity in metals, Concept of Resistivity and Mobility, Numerical Problems on resistivity and mobility, Assumptions and failures of Classical Free Electron Theory, Assumptions and success of Quantum Free Electron Theory, Fermi Energy (Qualitative).

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Superconductivity :

Introduction to Super Conductors, Temperature dependence of resistivity, Meissner Effect, Critical Field, Temperature dependence of Critical field & Numerical Problems, Types of Super Conductors, BCS theory (Qualitative), High Temperature superconductivity, Josephson Junctions(Qualitative), SQUIDs (Qualitative), Applications of superconductors - Maglev vehicle, SQUID

Pre requisites: Basics of Electrical conductivity
Self-learning: Resistivity and mobility

Module-4 (8 Hours)

Quantum Information & Quantum Computing:

Principles of Quantum Information & Quantum Computing: Introduction to Quantum Computing, Moore's law & its end. Single particle quantum interference, Differences between classical & quantum computing, concept of qubit and its properties. Representation of qubit by Bloch sphere. Single and Two qubits. Extension to N qubits.

Properties of a qubit: Mathematical representation. Summation of probabilities.

Dirac representation and matrix operations: Matrix representation of 0 and 1 states, Identity Operator I, Determination of I|0> and I|1>, Pauli Matrices and its operations on |0> and |1> states, Explanation of i) Conjugate of a matrix ii) Transpose of a matrix. Unitary Matrix U, Examples:Row and Column Matrices and their multiplication (Inner Product).

Pre requisites: Matrices
Self-learning: Moore's law

Module-5 (8 Hours)

Quantum Gates & Physics of Animation :

Quantum Gates

Single Qubit Gates: Quantum Not Gate , Pauli -Z Gate, Hadamard Gate, Phase Gate (or S Gate), T Gate

Multiple Qubit Gates: Controlled gate, CNOT Gate, (Discussion for 4 different input states). Representation of Swap gate, Controlled -Z gate, Toffoli gate.

Physics of Animation :

Taxonomy of physics based animation methods, Frames, Frames per Second, Size and Scale, Motion and Timing in Animations, Constant Force and Acceleration. The Odd rule, Odd rule Scenarios & Numerical Problems, Motion Graphs.

Pre requisites: Motion in one dimension
Self-learning: Frames, Frames per Second

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1	**Describe** the principles of LASERS and Optical fibers and their relevant applications.
CO2	**Summarize** the essential properties of conductors and superconductors.
CO3	**Discuss** the basic principles of the Quantum Mechanics.
CO4	**Discuss** the basics of Quantum Computing and Quantum Gates
CO5	**Illustrate** the application of physics in design and data analysis.

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DEPT OF PHYSICS
ENGINEERING PHYSICS SYLLABUS

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 45% of the maximum marks (23 marks out of 50). The minimum passing marks for the SEE is 35% of the maximum marks (18 marks out of 50).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum and total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

The CIE shall be conducted by the course teacher throughout the semester. The suggested components of CIE for Theory course are

The CIE marks for the theory component shall be 50 marks is as detailed below

- Three Tests each of 15 Marks; (Third test is improvement test).
- CIE will be conducted by the university as per scheduled time table with question papers for the subject (duration of 1 hour 15 minutes)
- Session wise assignments for 25 marks
- For Seminar and library work 05 marks
- Attendance 5 marks (95% to 100%), 04 marks (85% to 94%)

Semester End Examination (SEE)

- Theory SEE will be conducted by University as per the scheduled time table, with question papers for the subject (duration 03 hours)
- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50 marks.
- The question paper will have ten full questions carrying equal marks.
- Each full question carries 20 marks.
- There will be two full questions (with a maximum of three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Solid State Physics, S O Pillai, New Age International Private Limited, 8th Edition, 2018,.
2. Engineering Physics by Gupta and Gour, Dhanpat Rai Publications, 2016 (Reprint).
3. Concepts of Modern Physics, Aurthur Beiser, McGrawhill, 6th Edition, 2009.
4. Lasers and Non Linear Optics, B B Loud, New age international, 2011 edition.
5. A text book of Engineering Physics by M .N. Avadhanulu, P G. Kshirsagar and T V S Arun Murthy, Eleventhedition, S Chand and Company Ltd. New Delhi-110055.
6. Quantum Computation and Quantum Information, Michael A. Nielsen & Isaac L. Chuang, Cambridge UniversitiesPress, 2010 Edition.
7. Quantum Computing, Vishal Sahani, McGraw Hill Education, 2007 Edition.
8. Engineering Physics, S P Basavaraj, 2005 Edition,
9. Physics for Animators, Michele Bousquet with Alejandro Garcia, CRC Press, Taylor & Francis, 2016.
10. Quantum Computation and Logic : How Quantum Computers Have Inspired Logical Investigations,Maria LuisaDalla Chiara, Roberto Giuntini, Roberto Leporini, Giuseppe Sergioli,TrendsinLogic, Volume 48, Springer.
11. Statistical Physics : Berkely Physics Course, Volume 5, F. Reif, McGraw Hill.

Web links and Video Lectures (e-Resources):

Web links:

1. **LASER :** www.youtube.com/watch?v=WgzynezPiyc
2. **Superconductivity :** https://www.youtube.com/watch?v=MT5XI5ppn48
3. **Optical Fiber :** www.youtube.com/watch?v=N_kA8EpCUQo

4. **Quantum Mechanics :** https://www.youtube.com/watch?v=p7bzE1E5PMY&t=136s
5. **Quantum Computing :** https://www.youtube.com/watch?v=jHoEjvuPoB8
6. **Physics of Animation :** www.youtube.com/watch?v=kj1kaA_8Fu4
7. **NPTEL Supercoductivity:** https://archive.nptel.ac.in/courses/115/103/115103108/
8. **NPTEL Quantum Computing :** https://archive.nptel.ac.in/courses/115/101/115101092
9. **Virtual LAB :** https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
10. **Virtual LAB :** https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=343&cnt=1

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

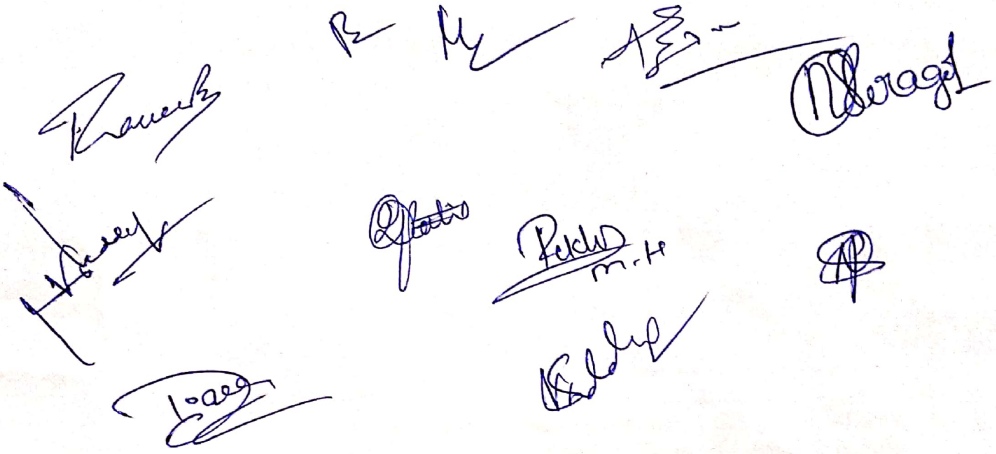
http://nptel.ac.in

https://swayam.gov.in

https://virtuallabs.merlot.org/vl_physics.

htmlhttps://phet.colorado.edu

https://www.myphysicslab.com



SHARNBASVA UNIVERSITY
DEPT OF PHYSICS
ENGINEERING PHYSICS SYLLABUS

Course Title:	Engineering Physics for EEE Stream		
Course Code:	22PHYE12/22	CIE Marks	50
Course Type (Theory/Practical)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L+T)	03	Exam Hours	03
Total Hours of Pedagogy	40 hrs	Credits	03

Course objectives

- To study the essentials of photonics for engineering applications.
- To understand the properties of dielectrics and superconductors
- To study the principles of quantum mechanics.
- To understand fundamentals of vector calculus and EM waves.
- To study the knowledge about semiconductors and devices

Teaching-Learning Process

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes andmake Teaching –Learning more effective

1. Flipped Class
2. Smart Class Room
3. Blended Mode of Learning
4. Interactive Simulations and Animations
5. Assignments based learning
6. NPTEL and Other Videos for theory topics
7. Lab Experiment Videos

Module-1 (8 Hours)

Lasers: Characteristics of LASER, Interaction of radiation with matter, Expression for energy density of radiation and Numerical Problems, Requisites of a Laser system, Conditions for Laser action, Types of Lasers, Principle, Construction and working of Ga-As laser. Application of Lasers in Defence (Laser range finder) and Laser Printing.

Optical Fibers: Propagation mechanism, TIR, angle of acceptance, Numerical aperture and Numerical Problems on NA, fractional index change, Modes of propagation, Number of modes and V parameter and Numerical Problems, Types of optical fibers. Attenuation and Mention of expression for attenuation coefficient, Discussion of block diagram of point to point communication, Merits and demerits of optical fiber.

Pre requisite: Properties of light

Self-learning: Propagation Mechanism &TIR in optical fiber

Module-2 (8 Hours)

Dielectric Properties: Basic concepts of conductors, insulators and semiconductors, Polar and non-polar dielectrics, Types of Polarization, internal fields in solid, solid, liquid and gaseous dielectrics. Application of dielectrics in transformers, Capacitors.

Superconductivity:

Introduction to Superconductors, Temperature dependence of resistivity, Meissner Effect, Critical temperature, Types of Super Conductors, Temperature dependence of Critical field & Numerical Problems, BCS theory (Qualitative), High Temperature superconductivity, Applications of Superconductivity - SQUID, MAGLEV.

Pre requisites: Difference between Insulators & Dielectrics.

Self-learning: Dielectrics Basics

Module-3 (8 Hours)

Quantum Mechanics:

Inadequacies of Classical Mechanics (Blackbody radiation & Photo electric effect), de Broglie Hypothesis and Matter Waves, de Broglie wavelength, Heisenberg's Uncertainty Principle and its application (Non existence of electron inside the nucleus-Non Relativistic) & Numerical Problems, Wave Function, Time independent

Schrodinger wave equation, Physical Significance of a wave function, Eigen functions and Eigen Values, Motion of a particle in a one dimensional potential well of infinite depth.

Pre requisite:Wave–Particle dualism
Self-learning: de Broglie Hypothesis

Module-4 (8 Hours)

Maxwell's Equations and EM waves:
Maxwell's Equations: Fundamentals of vector calculus. Divergence and curl of electric field and magnetic field (static) & Numerical Problems, Gauss' divergence theorem and Stoke's theorem, Faraday's laws of EMI, Current density & equation of continuity; displacement current (with derivation) Maxwell's equations in vacuum.
EM Waves: Plane electromagnetic waves in vacuum, their transverse nature, Numerical problems.
Pre requisite:Electricity & Magnetism
Self-learning: Fundamentals of vector calculus.

Module-5 (8 Hours)

Semiconductor and Devices:
Fermi energy and Fermi factor, Variation of Fermi factor with temperature and energy & Numerical Problems, Fermi level in intrinsic semiconductors, Electrical conductivity of a semiconductor (derivation) & Numericals, Hall effect and mention its application, Photodiode and Power responsivity, Four probe method to determine resistivity, Photo transistor.
Pre requisite: Basics of Semiconductors
Self-learning: Solar cell

Course outcome (Course Skill Set)
At the end of the course the student will be able to:

CO1	**Discuss** the essential concepts of Lasers and Optical fibers.
CO2	**Elucidate** the concepts of dielectrics and superconductivity.
CO3	**Describe** the fundamental principles of the Quantum Mechanics.
CO4	**Discuss** the fundamentals of vector calculus and their applications in Maxwell's Equations and EM Waves.
CO5	**Summarize** the properties of semiconductors and the working principles of semiconductor devices.

Assessment Details (both CIE and SEE)
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 45% of the maximum marks (23 marks out of 50). The minimum passing marks for the SEE is 35% of the maximum marks (18 marks out of 50).
A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum and total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):
The CIE shall be conducted by the course teacher throughout the semester. The suggested components of CIE for Theory course are
The CIE marks for the theory component shall be 50 marks is as detailed below

- Three Tests each of 15 Marks; (Third test is improvement test).
- CIE will be conducted by the university as per scheduled time table with question papers for the subject (duration of 1 hour 15 minutes)
- Session wise assignments for 25 marks
- For Seminar and library work 05 marks
- Attendance 5 marks (95% to 100%), 04 marks (85% to 94%)

Semester End Examination (SEE)

- Theory SEE will be conducted by University as per the scheduled time table, with question papers for the subject (duration 03 hours)
- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50 marks.
- The question paper will have ten full questions carrying equal marks.

SHARNBASVA UNIVERSITY
DEPT OF PHYSICS
ENGINEERING PHYSICS SYLLABUS

- Each full question carries 20 marks.
- There will be two full questions (with a maximum of three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. A Text book of Engineering Physics- M.N. Avadhanulu and P.G. Kshirsagar, 10th revised Ed, S. Chand. & Company Ltd, New Delhi.
2. An Introduction to Lasers theory and applications by M.N.Avadhanulu and P.S.Hemne revised Edition 2012 . S.Chand and company Ltd -New Delhi.
3. Engineering Physics-Gaur and Gupta-Dhanpat Rai Publications-2017.
4. Concepts of Modern Physics-Arthur Beiser: 6th Ed; Tata McGraw Hill Edu Pvt Ltd- New Delhi 2006.
5. Fundamentals of Fibre Optics in Telecommunication & Sensor Systems, B.P. Pal, New Age International Publishers.
6. Introduction to Electrodynamics, David Griffith, 4th Edition, Cambridge University press 2017.
7. Lasers and Non Linear Optics – B.B. Laud, 3rd Ed, New Age International Publishers 2011.
8. LASERS Principles, Types and Applications by K.R. Nambiar-New Age International Publishers.
9. Solid State Physics-S O Pillai, 8th Ed- New Age International Publishers-2018.

Web links and Video Lectures (e-Resources):

Web links:

1. **Laser:** www.britannica.com/technology/laser,k
2. **Laser:** https://nptel.ac.in/courses/115/102/115102124/
3. **Quantum Mechanics:** https://nptel.ac.in/courses/115/104/115104096/
4. **Physics:** http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
5. **Numerical Aperture of fiber:** https://bop-iitk.vlabs.ac.in/exp/numerical-aperture-measurement

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

http://nptel.ac.in
https://swayam.gov.in
https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=343&cnt=1
https://virtuallabs.merlot.org/vl_physics.
htmlhttps://phet.colorado.edu
https://www.myphysicslab.com

SHARNBASVA UNIVERSITY
DEPT OF PHYSICS
ENGINEERING PHYSICS SYLLABUS

Course Title:	Physics for ME Stream		
Course Code:	22PHYM12/22	CIE Marks	50
Course Type (Theory/Practical)	Theory	SEE Marks	50
Teaching Hours/Week (L+T)	03	Total Marks	100
Total Hours of Pedagogy	40 hrs	Exam Hours	03
		Credits	03

Course objectives

- To understand the types of oscillation, shock waves & its generation, and applications.
- To Study the elastic properties of materials and failures of engineering materials
- To understand the fundamentals of thermoelectric materials and devices and their application.
- To understand the Concepts in Lasers, Low temperature phenomena and generation of low temperature.
- To study the various relevant material characterization techniques

Teaching-Learning Process

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes andmake Teaching –Learning more effective

1. Flipped Class
2. Smart Class Room
3. Blended Mode of Learning
4. Interactive Simulations and Animations
5. Assignments based learning
6. NPTEL and Other Videos for theory topics
7. Lab Experiment Videos

Module-1 (8 Hours)

Oscillations: Simple Harmonic motion (SHM), differential equation for SHM, series and parallel combination of springs (Derivation), Damped oscillations and equation of motion for damped oscillation (derivation), Engineering applications of damped oscillations, Forced oscillations and differential equation of forced oscillation (derivation), resonance, sharpness of resonance. Numerical Problems.

Shock waves: Mach number and Mach Angle, Mach Regimes, definition and characteristics of Shock waves, Construction and working of Reddy shock tube, Applications of Shock Waves.

Pre-requisites: Basics of Oscillations

Self-learning: Simple Harmonic motion, differential equation for SHM

Module-2 (8 Hours)

Elasticity:

Elasticity, Types of stress and strain, Hooke's law, Elastic Moduli, Poisson's ratio, Beams, bending moment of a beam (derivation), Cantilever and Young's modulus of a single cantilever (derivation) and MEMS and its application as a sensor, Failures of Engineering materials - ductile fracture, brittle fracture, torsion of a cylinder (derivation). Numerical problems

Pre requisites: Elasticity, Stress & Strain

Self-learning: Stress-Strain Curve

Module-3 (8 Hours)

Thermoelectric materials and devices:

Thermo emf and thermo current, Seeback effect, Peltier effect, Seeback and Peltier coefficients, figure of merit (Mention Expression), laws of thermoelectricity. Construction and Working of Thermoelectric generators (TEG) and Thermoelectric coolers (TEC), low, mid and high temperature thermoelectric materials, Applications: Exhaust of Automobiles, Space Program (RTG), Numerical Problems.

Pre requisites: Basics of Electrical conductivity

Self-learning: Thermo-emf and Thermo current

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Module-4 (8 Hours)

LASER : Basic properties of a LASER beam, Interaction of Radiation with Matter, Einstein's A and B Coefficients, Laser Action & Numerical Problems, Population Inversion, Metastable State, Requisites of a laser system, Types of Lasers, Carbon dioxide Laser, Applications: Laser welding, Laser cutting and Laser drilling.
Cryogenics: Production of Low temperature – Joule-Thomson effect, Porous plug experiment, Cascade Process. Applications of Cryogenics, in aerospace and food processing (Qualitative).
Pre requisites: Basics of Heat and Thermodynamics
Self-learning: Joule Thomson effect.

Module-5 (8 Hours)

Material Characterization and Instrumentation Techniques:
Introduction to nano materials: Nanomaterial and nanocomposites. Principle, construction and working of X-ray Diffractometer, crystallite size determination by Scherrer equation, Principle, construction, working and applications of Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Numerical Problems.
Pre requisites: Principle and working of optical Microscope
Self-learning: X-Ray Diffractometer

Course outcome (Course Skill Set)
At the end of the course the student will be able to:

CO1	**Elucidate** the concepts in oscillations and waves,
CO2	**Discuss** concepts of elasticity and material failures.
CO3	**Discuss** the fundamentals of Thermoelectric materials and their application
CO4	**Summarize** the low temperature phenomena and generation of low temperature
CO5	**Explain** the various material characterization techniques

Assessment Details (both CIE and SEE)
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 45% of the maximum marks (23 marks out of 50). The minimum passing marks for the SEE is 35% of the maximum marks (18 marks out of 50).
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Continuous Internal Evaluation(CIE):
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- Session wise assignments for 25 marks
- For Seminar and library work 05 marks
- Attendance 5 marks (95% to 100%), 04 marks (85% to 94%)

Semester End Examination (SEE)

- Theory SEE will be conducted by University as per the scheduled time table, with question papers for the subject (duration 03 hours)
- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50 marks.
- The question paper will have ten full questions carrying equal marks.
- Each full question carries 20 marks.
- There will be two full questions (with a maximum of three sub questions) from each module.

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DEPT OF PHYSICS
ENGINEERING PHYSICS SYLLABUS

- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Vibrations and Waves (MIT introductory Physics Series), A P French, CBS, 2003 Edition
2. Timoshenko, S. and Goodier J.N. "Theory of Elasticity", 2nd Edition, McGraw Hill Book Co, 2001.
3. Sadhu Singh, "Theory of Elasticity", Khanna Publishers, 1997
4. Mechanical Properties of Engineered Materials By Wole Soboyejo, CRC Press; 1st edition, 2002
5. Heat & Thermodynamics and Statistical Physics(XVIII-Edition) – Singhal, Agarwal &Satyaprakash – PragatiPrakashan, Meerut, 2006. 4
6. Heat and Thermodynamics (I-Edition) – D.S.Mathur - S. Chand & Company Ltd., New-Delhi, 1991
7. Physics of Cryogenics by Bahman Zohuri, Elsevier, 2018
8. Materials Characterization Techniques-Sam Zhang, Lin Li, Ashok Kumar, CRC Press, First Edition, 2008.
9. Characterization of Materials- Mitra P.K . Prentice Hall India Learning Private Limited.
10. Nanoscience and Nanotechnology: Fundamentals to Frontiers – M.S.Ramachandra Rao & Shubra Singh, WileyIndia Pvt Ltd .
11. Nano Composite Materials-Synthesis, Properties and Applications, J. Parameswaranpillai,, N.Hameed,T.Kurian, Y. Yu, CRC Press.

Web links and Video Lectures (e-Resources):

Web links

1. **Simple Harmonic motion:** https://www.youtube.com/watch?v=k2FvSzWeVxQhttps://www.youtube.com/watch?v=k2FvSzWeVxQ
2. **Shock waves:** https://physics.info/shock/
3. **Shock waves and its applications:** https://www.youtube.com/watch?v=tz_3M3v3kxk
4. **Stress-strain curves:** https://web.mit.edu/course/3/3.11/www/modules/ss.pdf
5. **Fracture in materials:** https://www.youtube.com/watch?v=x47nky4MbK8
6. **Thermoelectricity:** https://www.youtube.com/watch?v=2w7NBuu5w9c&list=PLtkeUZItwHK5y6qy1GFxa4Z4RcmzU aaz6
7. **Thermoelecrtic generator and coolers:** https://www.youtube.com/watch?v=NruYdb31xk88
8. **Cryogenics:** https://cevgroup.org/cryogenics-basics-applications/
9. **Liquefaction of gases:** https://www.youtube.com/watch?v=aMelwOsGpIs
10. **Virtual lab:** https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
11. **Material Characterization:** https://onlinecourses.nptel.ac.in/noc20_mm14/preview

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

http://nptel.ac.in
https://swayam.gov.in
https://virtuallabs.merlot.org/vl_physics.
htmlhttps://phet.colorado.edu
https://www.myphysicslab.com

SHARNBASVA UNIVERSITY
DEPT OF PHYSICS
ENGINEERING PHYSICS SYLLABUS

Course Title:	Engineering Physics for CV Stream		
Course Code:	22PHYC12/22	CIE Marks	50
Course Type (Theory/Practical)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week(L+T)	03	Exam Hours	03
Total Hours of Pedagogy	40 hrs	Credits	03

Course objectives

- To understand the types of oscillation, shock waves & its generation, and applications.
- To Study the elastic properties of materials and failures of engineering materials
- To Study the acoustics buildings.
- To understand the principles photonic devices and their application relevant to civil engineering.
- To understand the various natural disaster and safety.

Teaching-Learning Process

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes andmake Teaching –Learning more effective

1. Flipped Class
2. Smart Class Room
3. Blended Mode of Learning
4. Interactive Simulations and Animations
5. Assignments based learning
6. NPTEL and Other Videos for theory topics
7. Lab Experiment Videos

Module-1 (8 Hours)

Oscillations and Shock waves:

Oscillations: Simple Harmonic motion (SHM), differential equation for SHM & Numericals, series and parallel combination of springs (Derivation) & Numericals, Damped oscillations and equation of motion for damped oscillation (derivation), Tuned Mass Damper (TMD) (Qualitative), Forced oscillations and differential equation of forced oscillation (derivation), resonance, sharpness of resonance.

Shock waves: Mach number and Mach Angle, Mach Regimes, definition and characteristics of Shock waves, Construction and working of Reddy shock tube, Applications of Shock Waves in treatment of dry borewell.

Pre-requisites: Basics of Oscillations

Self-learning: Simple Harmonic motion, differential equation for SHM

Module-2 (8 Hours)

Elasticity:

Elasticity, Types of stress and strain, Hooke's law & stress-strain diagram, Elastic Moduli & Numericals, Poisson's ratio, Failures of Engineering materials - ductile fracture, brittle fracture, Beams, bending moment of a beam (derivation), Cantilever and Young's modulus of a single cantilever (derivation) and its Engineering Application (Cantilever Bridge). Torsion of a cylinder (derivation) & Numericals.

Pre requisites: Elasticity, Stress & Strain

Self-learning: Stress-Strain Curve

Module-3 (8 Hours)

Acoustics:

Introduction to acoustics, Types of Acoustics, reverberation and reverberation time & Numericals, absorption power and absorption coefficient, Requisites for acoustics in auditorium, Sabine's formula (derivation & numericals), Measurement of absorption coefficient, factors affecting the acoustics and remedial measures, Noise and its Measurements, Sound Insulation and its measurements. Impact of Noise in Multi-storied buildings

Pre requisites: Basics of Sound, Waves & light properties

Self-learning: Introduction to acoustics

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ENGINEERING PHYSICS SYLLABUS

Module-4 (8 Hours)

LASER

Properties of a LASER Beam, Interaction of Radiation with Matter, LASER action, Population Inversion, Metastable State, Requisites of a LASER System, Types of Lasers, Gallium-Arsenide LASER construction and working, LASER in Surveying and Ranging, Bridge deflection, Road Profiling. Numerical Problems.

Optical Fiber

Principle and Construction of Optical Fibers, Acceptance angle and NA, Expression for NA(derivation & numericals), Modes of Propagation,Attenuation and Fiber Losses & Numericals, Fiber Optic Displacement Sensor.

Pre requisite: Properties of light

Self-learning: Propagation Mechanism & TIR in optical fiber

Module-5 (8 Hours)

Natural hazards and Safety:

Introduction, Earthquake, (general characteristics, Physics of earthquake, Richter scale of measurement and earthquake resistant measures), Landslide (causes such as excess rain fall, geological structure, human excavation etc, types of land slide, adverse effects, engineering solution for land slides). Fire hazards and fire protection, fire-proofing materials, fire safety regulations and firefighting equipment - Prevention and safety measures. Building materials – Composite materials (Polymer composites, Ceramic composites and Metal composites)

Pre requisite: Oscillations

Self-learning: Richter scale

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1	**Elucidate** the concepts in oscillations & waves.
CO2	**Discuss** concepts of elasticity and material failures.
CO3	**Summarize** concepts of acoustics in buildings.
CO4	**Discuss** the principles of Photonic devices and their applications relevant to civil engineering.
CO5	**Describe** the various natural hazards and safety precautions.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 45% of the maximum marks (23 marks out of 50). The minimum passing marks for the SEE is 35% of the maximum marks (18 marks out of 50).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum and total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

The CIE shall be conducted by the course teacher throughout the semester. The suggested components of CIE for Theory course are

The CIE marks for the theory component shall be 50 marks is as detailed below

- Three Tests each of 15 Marks; (Third test is improvement test).
- CIE will be conducted by the university as per scheduled time table with question papers for the subject (duration of 1 hour 15 minutes)
- Session wise assignments for 25 marks
- For Seminar and library work 05 marks
- Attendance 5 marks (95% to 100%), 04 marks (85% to 94%)

Semester End Examination (SEE)

- Theory SEE will be conducted by University as per the scheduled time table, with question papers for the subject (duration 03 hours)
- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50 marks.
- The question paper will have ten full questions carrying equal marks.
- Each full question carries 20 marks.

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DEPT OF PHYSICS
ENGINEERING PHYSICS SYLLABUS

- There will be two full questions (with a maximum of three sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Materials Science and Engineering by R Balasubramaniam, second edition, Wiley India Pvt. Ltd. Ansari Road,Daryaganj, New Delhi-110002.
2. A text book of Engineering Physics by M .N. Avadhanulu, P G. Kshirsagar and T V S Arun Murthy, Eleventh edition,S Chand and Company Ltd. New Delhi-110055.
3. Engineering Physics by R. K. Gaur and S. L. Gupta, 2010 edition, Dhanpat Rai Publications Ltd., New Delhi-110002,
4. Building Science: Lighting and Accoustics, B. P. Singh and Devaraj Singh, Dhanpat Rai Publications (P) Ltc.,
5. Building Acoustics : Tor Eric Vigran, Taylor and Francis, 2008 Edition.
6. Photometry Radiometry and Measurements of Optical Losses, Micheal Bukshtab, Springer, 2nd edition.
7. Materials Science for Engineers by James F. Shackelford and Madanapalli K Muralidhara, sixth edition, PearsonEducation Asia Pvt. Ltd., New Delhi.
8. Lasers and Non Linear Optics, B B Loud, New Age Internationals, 2011 edition
9. Shock waves made simple by Chintoo S Kumar, K Takayama and K P J Reddy: Willey India Pvt. Ltd, Delhi 2014.
10. An Introduction to Disaster Management, Natural Disastr & Man Made Hazards, S. Vaidyanathan, IKON Books P
11. Natural Hazards, Edward Bryant, Cambridge University Press, 2nd Edition
12. Natural hazards, Earthquakes, Volcanoes, and landslides by Ramesh P Singh, and Darius Bartlett, CRC Press, Taylorand Francis group.
13. Principles of Fire Safety Engineering Understanding Fire & Fire Protection, Akhil Kumar Das, PHI Learning , IIEdition.
14. Disaster Management, R.Subramanaian,S.Chand Publishing,2018.

Web links and Video Lectures (e-Resources):

Web links:

1. **Simple Harmonic motion:** https://www.youtube.com/watch?v=k2FvSzWeVxQ
2. **Shock waves:** https://physics.info/shock/
3. **Shock waves and its applications:** https://www.youtube.com/watch?v=tz_3M3v3kxk
4. **Stress- strain curves:** https://web.mit.edu/course/3/3.11/www/modules/ss.pdf
5. **Stress curves:** https://www.youtube.com/watch?v=f08Y39UiC-o
6. **Oscillations and waves :** https://openstax.org › books › college-physics-2e
7. **Earthquakes:** www.asc-india.org
8. **Earthquakes and Hazards:** http://quake.usgs.gov/tsunami
9. **Landslide hazards:** http://landslides.usgs.gov
10. **Acoustics:** https://www.youtube.com/watch?v=fHBPvMDFyO8

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

http://nptel.ac.in

https://swayam.gov.in

https://virtuallabs.merlot.org/vl_physics.

htmlhttps://phet.colorado.edu

https://www.myphysicslab.com

SHARNBASVA UNIVERSITY

DEPT OF PHYSICS

ENGINEERING PHYSICS LAB

Course Title:	Engineering Physics Lab (Common for all Branches/Stream)		
Course Code:	22PHYL18/28	CIE Marks	50
Course Type (Theory/Practical)	Practical	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (Practical)	02	Exam Hours	02
Total Hours of Pedagogy	38 hrs	Credits	01

Course objectives

- To realize experimentally, the mechanical, electrical and thermal properties of materials, concept of waves and oscillations
- To design simple circuits and hence study the characteristics of semiconductor devices

List of Experiments

1. Determine Acceptance angle and Numerical aperture of an optical fiber.
2. Determine Wavelength of semiconductor laser using Laser diffraction by calculating grating constant.
3. Draw I-V characteristics of photodiode and calculate power responsivity.
4. Determination and Estimation of Fermi Energy of Copper.
5. Calculation of Dielectric constant by RC charging and Discharging.
6. Stefan's Law of radiation.
7. Determination of Planck's constant using Light Emitting Diodes.
8. Study of input and output Transistor characteristics and hence calculate input resistance, and output resistance.
9. n & I by Torsional pendulum (radius of the wire, mass and dimensions of the regular bodies to be given).
10. Young's modulus of a beam by Single Cantilever experiment.
11. Determination of spring constants in Series and Parallel combination.
12. Study Series and parallel LCR resonance and hence Calculate inductance, band width and quality factor using series LCR Resonance.
13. Young's modulus by uniform bending.
14. Study of I-V characteristics of Zener diode and determine the knee voltage and breakdown voltage.

Course Outcomes:

Upon completion of this course, students will be able to

- Apprehend the concepts of interference of light, diffraction of light, Fermi energy and magnetic effect of current
- Understand the principles of operations of optical fibers and semiconductor devices such as Photodiode, and NPN transistor using simple circuits
- Determine elastic moduli and moment of inertia of given materials with the help of suggested procedures
- Recognize the resonance concept and its practical applications
- Understand the importance of measurement procedure, honest recording and representing the data, reproduction of final results

CIE for the practical component

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 45% of the maximum marks (23 marks out of 50). The minimum passing marks for the SEE is 35% of the maximum marks (18 marks out of 50).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum and total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the practical component

- On completion of every experiment in the laboratory, the students shall be evaluated and marks shall be awarded on the same day.
- The 25 marks are for conducting the experiment and preparation of the laboratory record,10 marks for individual evaluation (which includes viva voce), (the average of total experiments}
- The 15 marks shall be for the test conducted at the end of the semester, for the subject (duration of 1 hour 15 minutes)

SEE for the practical component

- SEE marks for the practical course is 50 marks
- All laboratory experiments are to be included for the practical exam
- Break up marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners
- Students can pick one question (experiment) from the questions lot prepared by the examiners
- General rubrics suggested for SEE are mentioned here write up 15%, conduction procedure and result is 70% and viva voce 10% of maximum marks.
- Practical SEE will be conducted by University as per the scheduled time table, for the subject **(duration 02 hours).**

Web links and Video Lectures (e-Resources):

https://www.britannica.com/technology/laser,k
https://nptel.ac.in/courses/115/102/115102124/
https://nptel.ac.in/courses/115/104/115104096/
http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
https://onlinecourses.nptel.ac.in/noc20_mm14/preview

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning :

- http://nptel.ac.in https://swayam.gov.in
- https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham

SHARNBASVA UNIVERSITY
DEPT OF PHYSICS
INTRODUCTION TO NANOTECHNOLOGY SYLLABUS

Course Title:	Introduction to Nano Technology		
Course Code:	22ETC15L	CIE Marks	50
Course Type (Theory/Practical)	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week(L+T)	02	Exam Hours	03
Total Hours of Pedagogy	40 hrs	Credits	02

Course objectives

- To provide a comprehensive overview of synthesis and characterization of nanoparticles, nanocomposites and hierarchical materials with nanoscale features.
- To provide the engineering students with necessary background for understanding various nanomaterials characterization techniques
- To develop an understanding of the basis of the choice of material for device applications
- To give an insight into complete systems where nanotechnology can be used to improve our everyday life

Teaching-Learning Process

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes andmake Teaching –Learning more effective

1. Flipped Class
2. Smart Class Room
3. Blended Mode of Learning
4. Interactive Simulations and Animations
5. Assignments based learning
6. NPTEL and Other Videos for theory topics
7. Lab Experiment Videos

Module-1 (8 Hours)

Nanomaterials

Introduction, classification, Frontier of future-an overview, Length Scales, Variation of physical properties from bulk to thin films to nanomaterials, Confinement of electron in 0D, 1D, 2D and 3D systems, Surface to Volume Ratio, Synthesis of Nanomaterials: Bottom-Up approach: Chemical Routes for Synthesis of nanomaterials-Sol-gel, Precipitation, Solution Combustion synthesis, Hydrothermal, SILAR, Chemical Bath Deposition. Top-Down approach- Ball milling technique, Sputtering, Laser Ablation

Module-2 (8 Hours)

Characterization of Nanomaterials

Basic principles, construction and working instrumentations of Electron Microscopy –Transmission Electron Microscope, Scanning Electron Microscope, Scanning Probes- Scanning Tunneling microscope, Atomic

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DEPT OF PHYSICS
INTRODUCTION TO NANOTECHNOLOGY SYLLABUS

Basic principles of working of X-ray diffraction, derivation of Debye-Scherrer equation, numericals on Debye Scherrer equation, Optical Spectroscopy- Instrumentation and application of IR, UV/VIS (Band gap measurement)

Module-3 (8 Hours)

Carbon Based Materials

Introduction, Synthesis, Properties (electrical, Electronic and Mechanical), and Applications of Graphene, SWCNT, MWCNT, Fullerenes and other Carbon Materials: Carbon nanocomposites, nanofibres, nanodiscs, nanodiamonds.

Module-4 (8 Hours)

Nanotechnology in Energy storage and conversion

Solar cells: First generation, Second generation and third generation solar cells: Construction and working of Dye sensitized and Quantum dot sensitized solar cells.

Batteries: Nanotechnology in Lithium ion battery- working, Requirements of anodic and cathodic materials, classification based on ion storage mechanisms, limitations of graphite anodes, Advances in Cathodic materials, Anodic materials, Separators

Fuel Cells: Introduction, construction, working of fuel cells and nanotechnology in hydrogen storage and proton exchange membranes

Module-5 (8 Hours)

Applications of Nanotechnology

Nanotech Applications and Recent Breakthroughs: Introduction, Significant Impact of Nanotechnology and Nanomaterial, Medicine and Healthcare Applications, Biological and Biochemical Applications (Nano biotechnology), Electronic Applications (Nano electronics), Computing Applications (Nano computers), Chemical Applications (Nano chemistry), Optical Applications (Nano photonics), Agriculture and Food Applications, Recent Major Breakthroughs in Nanotechnology.

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1	Demonstrate the synthesis of nanoparticles by various techniques. [L2]
CO2	Explain working of basic instruments used in characterization of nanoparticles. [L2]
CO3	Discuss the application of nanotechnology to mechanical and civil domains [L2]
CO4	Classify the nanomaterials based on the dimensions. [L3]
CO5	Assess the suitability of nanomaterials for various device applications. [L4]

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Nano Materials – A.K. Bandyopadhyay/ New Age Publishers

SHARNBASVA UNIVERSITY
DEPT OF PHYSICS
INTRODUCTION TO NANOTECHNOLOGY SYLLABUS

2. Nanocrystals: Synthesis, Properties and Applications – C.N.R. Rao, P. John Thomas and G. U. Kulkarni, Springer Series in Materials Science
3. Nano Essentials- T. Pradeep/TMH
4. Peter J. F. Harris, Carbon nanotube science: synthesis, properties, and applications. Cambridge University Press, 2011
5. M.A. Shah, K.A. Shah, "Nanotechnology: The Science of Small", Wiley India, ISBN 13: 9788126538683

Reference Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Introduction to Nanotechnology, C. P. Poole and F. J. Owens, Wiley, 2003
2. Understanding Nanotechnology, Scientific American 2002
3. Nanotechnology, M. Ratner and D. Ratner, Prentice Hall 2003
4. Nanotechnology, M. Wildon, K. Kannagara, G. Smith, M. Simmons and B. Raguse, CRC Press Boca Raton 2002
5. Recent reviews on Li-ion batteries, solar cells and fuel cells

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/118104008
2. https://www.digimat.in/nptel/courses/video/118104008/L16.html
3. https://archive.nptel.ac.in/courses/113/106/113106099/
4. https://nptel.ac.in/courses/112107283
5. https://onlinecourses.nptel.ac.in/noc22_me131/preview

Sharnbasva University, Kalaburagi

Scheme for B.Tech., First Year Program from the Academic Year: 2022-23

All the B.Tech., branches offered by the University are grouped in to Four Streams (CES, MES, EES and CSS)

Semester, Physics Group - (for streams MES & EES including Mech, Energy, EEE and ECE branches)

e Code	Course Title	Teaching Department/ Paper Setting Board	Teaching hours/week				Examination				Credits
			Theory/ Lecture	Tutorial	Practical/ Drawing	Activities	Duration	CIE Marks	SEE Marks	Total Marks	
TM21	Mathematics for MES - II	Mathematics	3		2	0	3+2	50	50	100	4
TE21	Mathematics for EES -II		3		2	0	3+2	50	50	100	4
M22	Physics for MES	Physics	3		0	0	3	50	50	100	3
E22	Physics for EES		3		0	0	3	50	50	100	3
:23	Elements of Mechanical Engg (for Mech & Energy Engg. only)	Civil Engg	3 or 2 (for integrated)			0	3 or 3+2	50	50	100	3
23	Basic Electrical Engineering (for EEE only)	EEE	3 or 2 (for integrated)			0	3 or 3+2	50	50	100	3
23	Basic Electronics (for ECE only)	ECE	3 or 2 (for integrated)			0	3 or 3+2	50	50	100	3
24X	Engineering Science Course-II	Respective Dept.	2		0	0	3 or 3+2	50	50	100	2
25X	Emerging Technology Course-II/ Programming Language Course-II	Any Engg. Dept./ Any Dept.	3 or 2 (for integrated)			0	3 or 3+2	50	50	100	3
26X	Ability Enhancement Course-II	Any Dept.	*1 hour theory or 2 hours tutorial /practice/activities or any other combinations of all of them.*				1 or 2	50	50	100	1
S27/27	Samskrutika Kannada/Balake Kannada	Kannada					1 or 2	50	50	100	1
28	Physics Lab	Physics	0	0	2	0	2	50	50	100	1
29	Programming for Problem Solving Lab	CSE/AI&ML/ AI&DS	0	0	2	0	2	50	50	100	1
120	Project - II	*A batch of 4 to 5 students (same branch or different branches) with a guide, may udertake one project (1 hour of theory/tutorial or 2 hours of practice/activities)*					1 or 2	50	50	100	1
		Total						**500**	**500**	**1000**	**20**

e Course - (IC - Integrated Course)	MES: Mechanical Engineering Stream (M)
e Course	EES: Electrical & Electronics Engineering Stream (E)
ence Course - Open Elective	PROJ: Project
ology Course -Open Elective	SDC-OE: Skill Development Course - Open Elective
anguage Course - Open Elective	HSMC: Humanities, Social Sciences and Management Course
ment Course - Open Elective	

Sharnbasva University, Kalaburagi

Draft Scheme for B.Tech., First Year Program from the Academic Year: 2022-23

All the B.Tech., branches offered by the University are grouped in to Four Streams (CES, MES, EES and CSS)

B.Tech., I Semester, Physics Group - (for streams CES & CSS including Civil, CSE, AI&ML and AI&DS branches)

Sl. No.	Course	Course Code	Course Title	Teaching Department/ Paper Setting Board	Teaching hours/week				Examination				Credits
					Theory/ Lecture	Tutorial	Practical/ Drawing	Activities	Duration	CIE Marks	SEE Marks	Total Marks	
1	ASC (IC)	22MATC11	Mathematics for CES - I	Mathematics	3		2	0	3+2	50	50	100	4
		22MATS11	Mathematics for CSS - I		3		2	0	3+2	50	50	100	4
2	ASC	22PHYC12	Physics for CES	Physics	3		0	0	3	50	50	100	3
		22PHYS12	Physics for CSS		3		0	0	3	50	50	100	3
3	ESC	22CIV13	Engineering Mechanics for CES	Civil Engg	3 or 2 (for integrated)			0	3 or 3+2	50	50	100	3
		22PPC13	Principles of Programing with C for CSS	CSE/AI&ML/ AI&DS	3 or 2 (for integrated)			0	3 or 3+2	50	50	100	3
4	ESC-OE	22ESC14X	Engineering Science Course-I	Respective Dept.	3 or 2 (for integrated)			0	3 or 3+2	50	50	100	3
5	ETC-OE / PLC-OE	22ETC15X 22PLC15X	Emerging Technology Course-I or Programming Language Course - I	Any Engg. Dept./ Any Dept.	2		0	0	3 or 3+2	50	50	100	2
6	AEC-OE	22AEC16X	Ability Enhancement Course-I	Any Dept.	3 or 2 (for integrated)			0	3 or 3+2	50	50	100	3
7	HSMC	22HSM17	Samskrutika Kannada/Balake Kannada	Kannada	*1 hour theory or 2 hours tutorial /practice/activities or any other combinations of all of them.*				1 or 2	50	50	100	1
8	ASC-L	22PHYL18	Physics Lab	Physics					1 or 2	50	50	100	1
9	ESC-L	22PPSL19	Programming for Problem Solving Lab	CSE/AI&ML/ AI&DS	0	0	2	0	2	50	50	100	1
10	SDC - OE	22PROJ10	Project - I	*A batch of 4 to 5 students (same branch or different branches) with a guide, may udertake one project (1 hour of theory/tutorial or 2 hours of practice/activities)*	0	0	2	0	2	50	50	100	1
									1 or 2	50	50	100	1
Total										**500**	**500**	**1000**	**20**

ASC (IC) - Applied Science Course - (IC - Integrated Course)
ESC - Engineering Science Course
ESC-OE : Engineering Science Course - Open Elective
ETC-OE: Emerging Technology Course -Open Elective
PLC-OE : Programming Language Course - Open Elective
AEC-OE: Ability Enhancement Course - Open Elective

CES: Civil Engineering Stream (C)
CSE: Computer Science & Engineering Stream (S)
CAED: Computer Aided Engineering Design
SDC-OE: Skill Development Course - Open Elective
HSMC: Humanities, Social Sciences and Management Course

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1st Babaleshwar Peethadhipathi
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Chancellor, Sharnbasva University

Poojya Mateshri Dr. Dakshayini S. Appa
Chairperson,
Sharnbasveshwar Vidya Vardhak Sangha
Member of BOG Sharnbasva University

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Sharnbasveshwar Sansthan, Kalaburagi

Poojya Mateshri Godutai Avvaji

Poojya Doddappa Appa
1st Babaleshwar Peethadhipathi
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UGC Status: Letter No. F.8-29/2017(CPP-I/PU), Dated 20 Dec. 2017. Enlisted by the University Grants Commission, New Delhi, in the list of Private Universities in India.
A Private University enacted by Govt. of Karnataka as "Sharnbasva University Act. 2012" Karnataka Act No. 17 of 2013. Notification No. ED 144 URC 2016 dated 29/07/2017

Dr. Niranjan V. Nisty M.D.,Ph.D.
Vice-Chancellor

Sri N.S. Devarkal B.Sc.,M.A.,LL.B.
Pro Vice-Chancellor

Dr. V. D. Mytri M.Tech.,Ph.D.
Pro Vice-Chancellor

Dr. Anilkumar Bidve M.Sc.,Ph.D.
Registrar : Cell : 6362910165

Dr. Basavaraj S. Mathapati M.Tech.,Ph.D.
Registrar (Eval) : Cell : 9448650187

Dr. Lakshmi Patil M.Tech.,Ph.D.
Dean : Cell : 6362910168

Prof. Kiran Maka M.Tech.(Ph.D.)
Finance Officer : Cell : 9632294958

Faculty of Engg. & Tech.
B.Tech
1. Electronics & Comm. Engineering
2. Electrical & Elcetronics Engineering
3. Computer Science & Engineering
4. Civil Engineering
5. Mechanical Engineering
6. Energy Engineering
7. Artifical Intelligence (AI) & Data Science

M.Tech
1. Computer Science & Engineering
2. Computer Network & Engineering
3. Digital Electronics
4. VLSI & Embedded Systems
5. Machine Design Engineering
6. Structural Engineering
7. Artifical Intelligence & Data Science

Faculty of Engg & Tech (Exclusively for Women)
B.Tech.
1. Electronics & Comm. Engineering
2. Electrical & Elcetronics Engineering
3. Computer Science & Engineering
4. Civil Engineering
5. Artifical Intelligence & Machine Learning

M.Tech.
1. Computer Science & Engineering
2. Digital Comm. & Network

Faculty of Architecture
1. B. Arch:Bachelor of Architecture

Faculty of Business Studies
1. BBA- HR, Marketing, Finance
2. BBA- Tourism & Travel Mgmt.
3. BBA Logistics
4. MBA- HR, Marketing, Finance
5. MBA-Hospital Management
6. MBA- Tourism & Travel Mgmt.
7. M.Com.

(Exclusively for Women)
1. MBA-HR, Marketing, Finance
2. BBA-HR, Marketing, Finance
3. BBA-Aviation Services & Air Cargo

Faculty of Social Science
1. M.A. Journalism & Mass Comm.

Faculty of Science & Tech.
1. M.Sc. Physics 2. M.Sc. Maths
3. M.Sc. Zoology 4. M.Sc. Botany

Faculty of Computer Application
1. MCA 2. BCA

(Exclusively for Women)
1. BCA

Faculty of Fine Art
1. M.A. Visual Arts

Faculty of Music
1. M.A. Music

Faculty of Languages
1. M.A. Kannada 2. M.A. English

Proposed Programes
1. M.Sc. Data Science
2. M.Sc./M.A. Yoga
3. M.A. Sanskrit

Date: 05-11-2022

CONSTITUTION OF BOARD OF STUDIES IN CHEMISTRY

Reference: 1. Hon. Vice Chancellor's approval dated 04/11/2022

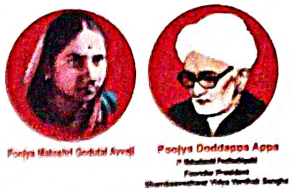
With reference to the above cited subject and references, the Board of Studies in Mathematics for the period of two academic years i.e. 2022-2023 and 2023-2024 has been constituted as below.

Sl. No.	Name and address of the Member	Appointed As
1	Dr.Nirdosh Patil Professor and Chairman, B.Tech (Co-Ed) Dept. of Chemistry, Sharnbasva University. Kalaburagi	**Chairman**
	Internal Members	
2	Dr. Parvati S G Associate Professor, Department of Chemistry, B.Tech (Co-Ed) Sharnbasva University. Kalaburagi	Member
3	Dr. Shweta Patil Associate Professor, Department of Chemistry, B.Tech (Co-Ed) Sharnbasva University. Kalaburagi	Member
4	Prof Anita R H Assistant Professor, Dept. of Chemistry, B.Tech (Ex-Women) Sharnbasva University. Kalaburagi	Member
5	Prof Sangeeta Aland Assistant Professor, Dept. of Chemistry, B.Tech (Ex-Women) Sharnbasva University. Kalaburagi	Member
	External Members	
6	Dr. R S Malipatil Associate Professor, Department of Chemistry, Poojya Doddappa Appa College of Engineering, Kalaburagi.	Member

ಶರಣಬಸವ ವಿಶ್ವವಿದ್ಯಾಲಯ
Sharnbasva University

Kalaburagi - 585103, Karnataka - India
ಕಲಬುರಗಿ 585 103 ಕರ್ನಾಟಕ - ಭಾರತ

Phone / Fax No. 08472-277852, 277853, 277854, 277855 www.sharnbasvauniversity.edu.in - email : Sharnbasvauniversity@gmail.com



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Dr. Niranjan V. Nisty M.D., Ph.D.
Vice-Chancellor

Sri N.S. Devarkal B.Sc, M.A., LL.B.
Pro Vice-Chancellor

Dr. V. D. Mytri M.Tech., Ph.D
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Dr. Lakshmi Patil M.Tech., Ph.D
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Prof. Kiran Maka M.Tech (Ph.D.)
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Faculty of Engg. & Tech.
B.Tech
1. Electronics & Comm. Engineering
2. Electrical & Elcetronics Engineering
3. Computer Science & Engineering
4. Civil Engineering
5. Mechanical Engineering
6. Energy Engineering
7. Artifical Intelligence (AI) & Data Science
M.Tech
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3. Digital Electronics
4. VLSI & Embedded Systems
5. Machine Design Engineering
6. Structural Engineering
7. Artifical Intelligence & Data Science
Faculty of Engg & Tech (Exclusively for Women)
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1. MCA 2. BCA
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Faculty of Fine Art
1. M.A. Visual Arts
Faculty of Music
1. M.A. Music
Faculty of Languages
1. M.A. Kannada 2. M.A. English
Proposed Programes
1. M.Sc. Data Science
2. M.Sc./M.A. Yoga
3. M.A. Sanskrit

7	Dr. Kashinath K Professor, Department of Chemistry, K C T Engg. College Kalaburagi.	Member
8	Dr. Shivakumar R Assistant Professor, Department of Chemistry, Govt. Degree College, Kalaburagi, Gulbarga University, Kalaburagi.	Member
9	Prof. Siddangouda Patil Assistant Professor, Department of Chemistry, Veerappa Nisty Engineering College Shorapur,	Member

Term of the nominated Members shall be two years from the date of this order.

REGISTRAR

Copy to:

1. The Hon. Vice chancellor, for the information
2. Chairman, Board of Studies in Chemistry.
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Estd. 2017
ಸ್ಥಾಪನೆ : 2017

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Board of Studies Members Sub Committee-I in Chemistry
For Circuit Branches [ECE, EEE, CSE and AI&DS]

Sl. No.	Name and address of the Member	Appointed As
1	**Prof. Ambresh Reddy** Assistant Professor, Dept. of Chemistry, Faculty of Engineering and Technology(Co-ed), Sharnbasva University, Kalaburagi.	Member
2	**Prof. Earamma Patil** Assistant Professor, Department of Chemistyr, Faculty of Engineering and Technology (Co-ed) Sharnbasva University, Kalaburagi.	Member
3	**Dr. Nagabhushan Patil** Professor, Department of Electrical and Electronics Engineering, Faculty of Engineering and Technology (Co-ed)Sharnbasva University, Kalaburagi.	Member
4	**Dr. ShashidharSonnad** Professor & Chairman Deparment of Electronics & Communication Engg, Faculty of Engineering and Technology(Co-ed), Sharnbasva University, Kalaburagi.	Member
5	**Dr. SujataMallapur** Professor & Chairman, Dept. of Artificial Intelligence and Machine Learning , Faculty of Engineering and Technology (Exclusively for Women), Sharnbasva University, Kalaburagi	Member
6	**Dr. SachinVeershetty** Associate Professor, Dept. of Computer Science & Engineering, Faculty of Engineering and Technology(Co-ed), Sharnbasva University, Kalaburagi.	Member

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Board of Studies Members Sub Committee-II in Chemistry
For Non- Circuit Branches [Energy Engg, Mech and Civil]

Sl. No.	Name and address of the Member	Appointed As
1	**Prof. Neha B** Assistant Professor, Dept. of Chemistry, Faculty of Engineering and Technology(Co-ed), Sharnbasva University, Kalaburagi.	Member
2	**Prof. Earamma Patil** Assistant Professor, Department of Chemistyr, Faculty of Engineering and Technology (Co-ed) Sharnbasva University, Kalaburagi.	Member
3	**Dr. Basavaraj Srigiri** Professor & Chairman, Dept. of Energy Engineering, Faculty of Engineering and Technology(Co-ed), Sharnbasva University, Kalaburagi.	Member
4	**Dr. S. S. Awanti** Professor, Dept. of Civil Engineering, Faculty of Engineering and Technology(Co-ed), Sharnbasva University, Kalaburagi.	Member

Term of the nominated Members shall be two years from the date of this order.

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REGISTRAR

Sharnbasva University, Kalaburagi

Scheme for B.Tech., First Year Program from the Academic Year: 2022-23

All the B.Tech., branches offered by the University are grouped in to Four Streams (CES, MES, EES and CSS)

B.Tech., I Semester, Chemistry Group - (for streams MES & EES including Mech., Energy, EEE & ECE branches)

Sl. No.	Course	Course Code	Course Title	Teaching Department/ Paper Setting Board	Teaching hours/week				Examination				Credits
					Theory/ Lecture	Tutorial	Practical/ Drawing	Activities	Duration	CIE Marks	SEE Marks	Total Marks	
1	ASC (IC)	22MATM11	Mathematics for MES - I	Mathematics	3		2	0	3+2	50	50	100	4
		22MATE11	Mathematics for EES - I		3		2	0	3+2	50	50	100	4
2	ASC	22CHEM12	Chemistry for MES	Chemistry	3		0	0	3	50	50	100	3
		22CHEE12	Chemistry for EES		3		0	0	3	50	50	100	3
3	ESC	22CED13	CAED	Mech Engg	2		2	0	3 or 3+2	50	50	100	3
4	ESC-OE	22ESC14X	Engineering Science Course-I	Respective Dept.	2		0	0	3 or 3+2	50	50	100	2
5	ETC-OE / PLC-OE	22ETC15X/ 22PLC15X	Emerging Technology Course-I or Programming Language Course - I	Any Engg. Dept./ Any Dept.	3 or 2 (for integrated)			0	3 or 3+2	50	50	100	3
6	AEC-OE	22AEC16X	Ability Enhancement Course-I	Any Dept.	*1 hour theory or 2 hours tutorial /practice/activities or any other combinations of all of them.*				1 or 2	50	50	100	1
7	HSMC	22CIPE17	Indian Constitution	Respective Dept					1 or 2	50	50	100	1
8	ASC-L	22CHEL18	Chemistry Lab	Chemistry	0	0	2	0	2	50	50	100	1
9	ESC-L	22EECL19	Electronics and Electrical Lab	ECE or EEE	0	0	2	0	2	50	50	100	1
10	SDC - OE	22PROJ10	Project - I	*A batch of 4 to 5 students (same branch or different branches) with a guide, may udertake one project (1 hour of theory/tutorial or 2 hours of practice/activities)*					1 or 2	50	50	100	1
Total										**500**	**500**	**1000**	**20**

ASC (IC) - Applied Science Course - (IC - Integrated Course)	MES: Mechanical Engineering Stream (M)
ESC - Engineering Science Course	EES: Electrical & Electronics Engineering Stream (E)
ESC-OE : Engineering Science Course - Open Elective	CAED: Computer Aided Engineering Design
ETC-OE: Emerging Technology Course -Open Elective	SDC-OE: Skill Development Course - Open Elective
PLC-OE : Programming Language Course - Open Elective	HSMC: Humanities, Social Sciences and Management Course
AEC-OE: Ability Enhancement Course - Open Elective	

Sharnbasva University, Kalaburagi

Scheme for B.Tech., First Year Program from the Academic Year: 2022-23

All the B.Tech., branches offered by the University are grouped in to Four Streams (CES, MES, EES and CSS)

B.Tech., II Semester, Chemistry Group - (for streams CES & CSS including CIV, CSE, AI&ML, AI&DS branches)

Sl. No.	Course	Course Code	Course Title	Teaching Department/ Paper Setting Board	Teaching hours/week				Examination				Credits
					Theory/ Lecture	Tutorial	Practical/ Drawing	Activities	Duration	CIE Marks	SEE Marks	Total Marks	
1	ASC (IC)	22MATC21	Mathematics for CES - II	Mathematics	3		2	0	3+2	50	50	100	4
		22MATS21	Mathematics for CSS - II		3		2	0	3+2	50	50	100	4
2	ASC	22CHEC22	Chemistry for CES	Chemistry	3		0	0	3	50	50	100	3
		22CHES22	Chemistry for CSS		3		0	0	3	50	50	100	3
3	ESC	22CED23	CAED	Mech Engg	2		2	0	3 or 3+2	50	50	100	3
4	ESC-OE	22ESC24X	Engineering Science Course-II	Respective Dept.	2		0	0	3 or 3+2	50	50	100	2
5	ETC-OE / PLC-OE	22ETC25X/ 22PLC25X	Emerging Technology Course-II/ Programming Language Course-II	Any Engg. Dept./ Any Dept.	3 or 2 (for integrated)			0	3 or 3+2	50	50	100	3
6	AEC-OE	22AEC26X	Ability Enhancement Course-II	Any Dept.	*1 hour theory or 2 hours tutorial /practice/activities or any other combinations of all of them.*				1 or 2	50	50	100	1
7	HSMC	22CIPE27	Indian Constitution	Respective Dept					1 or 2	50	50	100	1
8	ASC-L	22CHEL28	Chemistry Lab	Chemistry	0	0	2	0	2	50	50	100	1
9	ESC-L	22EECL29	Electronics and Electrical Lab	ECE or EEE	0	0	2	0	2	50	50	100	1
10	SDC - OE	22PROJ20	Project - II	*A batch of 4 to 5 students (same branch or different branches) with a guide, may udertake one project (1 hour of theory/tutorial or 2 hours of practice/activities)*					1 or 2	50	50	100	1
				Total						**500**	**500**	**1000**	**20**

ASC (IC) - Applied Science Course - (IC - Integrated Course)	CES: Civil Engineering Stream (C)
ESC - Engineering Science Course	CSS: Computer Science & Engineering Stream (S)
ESC-OE : Engineering Science Course - Open Elective	CAED: Computer Aided Engineering Design
ETC-OE: Emerging Technology Course -Open Elective	SDC-OE: Skill Development Course - Open Elective
PLC-OE : Programming Language Course - Open Elective	HSMC: Humanities, Social Sciences and Management Course
AEC-OE: Ability Enhancement Course - Open Elective	

SHARNBASVA UNIVERSITY

Mechanical Engineering and Allied branches

(Chemistry group)

Course Title:	**Applied Chemistry for Mechanical Engineering stream**		
Course Code:	**22CHEM12/22**	CIE Marks	50
Course Type	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L/T)	3	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Course objectives

- To enable students to acquire knowledge on principles of chemistry for engineering applications.
- To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.
- To provide students with a solid foundation in analytical reasoning required to solve societal problems.

Teaching-Learning Process

These are samples trategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching–Learning more effective

- Flipped class
- Smart class room
- Bended mode of leaning
- Interactive simulations and animation
- Tutorial & remedial classes for needy students (not regular T/R)
- Conducting Makeup classes
- Demonstration of concepts either by building models or by industry visit
- Experiments in laboratories shall be executed in blended mode (conventional or non–conventional methods)
- Use of ICT – Online videos, online courses
- Daily learning through assignments

Module-1: Energy Sources and Batteries (8 hr)

Fuels: Introduction, calorific value, determination of calorific value using bomb calorimeter, numerical problems on GCV and NCV.

Green fuels: Introduction, power alcohol, synthesis and applications of biodiesel.

High energy fuels: Production of hydrogen by electrolysis of water and its advantages.

Energy devices: Introduction, construction, working, and applications of Photovoltaic cells, Li-ion battery and methanol-oxygen fuel cell.

Module-2: Corrosion Science and Metal Finishing(8 hr)

Corrosion: Introduction, electrochemical theory of corrosion, types of corrosion-differential metal, differential aeration (waterline and pitting), stress corrosion (caustic embrittlement).

Corrosion control: Metal coating-galvanization, surface conversion coating-anodization and cathodic protection-sacrificial anode method. Corrosion testing by weight loss method. Corrosion penetration rate (CPR)-numerical problems.

Metal finishing: Introduction, technological importance. Electroplating: Introduction,

1. NOTE: Wherever the contact hours are not sufficient, tutorial hours can be converted to theory hours.

Electroplating of chromium (hard). Electroless plating: Introduction,electroless plating of nickel.

Module-3: Macromolecules for Engineering Applications (8 hr)

Polymers: Introduction, type of polymerization with examples (Addition and condensation), molecular weight of polymers, numerical problems. Synthesis, properties and engineering applications of polyethylene (PE) and polyvinyl chloride (PVC).
Fibers: Synthesis, properties and applications of Kevlar and nylon fibers.
Plastics: Introduction, synthesis, properties and industrial applications of poly(methyl methacrylate) (PMMA) and Teflon.
Polymer composites: Introduction, properties and applications of fiber reinforced polymers composites (FRPC),

Module-4: Phase Rule and Analytical Techniques (8 hr)

Phase rule: Introduction, Definition of terms: phase, components, degree of freedom, phase rule equation. Phase diagram: One component (water system) .
Analytical techniques: Introduction, principle, instrumentation of potentiometric sensors; its application in the estimation of iron, Optical sensors (colorimetry); its application in the estimation of the copper, pH-sensor (Glass electrode); its application in the determination of pH of beverages.

Module-5: Materials for Engineering Applications (8 hr)

Metals and Alloys: Introduction, Properties and application of Iron and its alloys,
Ceramics: Introduction, classification based on chemical composition, properties and applications of perovskites ($CaTiO_3$).
Nanochemistry: Introduction, size-dependent properties of nanomaterial (surface area and catalytical), synthesis of nanoparticles by sol-gel, and precipitation method.
Nanomaterials: Introduction, properties and engineering applications of carbon nanotubes and graphene.

Course outcome (Course Skill Set): At the end of the course, the student will be able to:	
CO1.	Identify the terms and Processes involved in scientific and engineering applications
CO2.	Explain the phenomena of chemistry to describe the methods of engineering Processes
CO3.	Solve the problems in chemistry that are pertinent in engineering applications
CO4.	Apply the basic concepts of chemistry to explain the chemical properties and Processes
CO5.	Analyze properties and Processes associated with chemical substances in multidisciplinary situations

Assessment Details (both CIE and SEE)

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 45% of the maximum marks (23 marks out of 50). The minimum passing marks for the SEE is 35% of the maximum marks (18 marks out of 50).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum and total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

The CIE shall be conducted by the course teacher throughout the semester. The suggested components of CIE for Theory course are

The CIE marks for the theory component shall be 50 marks is as detailed below

- Three Tests each of 15 Marks; (Third test is improvement test).
- CIE will be conducted by the university as per scheduled time table with question papers for the subject (duration of 1 hour 15 minutes)
- Session wise assignments for 25 marks
- For Seminar and library work 05 marks
- Attendance 5 marks (95% to 100%), 04 marks (85% to 94%)

Semester End Examination (SEE)

1. Theory SEE will be conducted by University as per the scheduled time table, with question papers for the subject **(duration 03 hours)**
2. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50 marks.
3. The question paper will have ten full questions carrying equal marks.
4. Each full question carries 20 marks.
5. There will be two full questions (with a maximum of three sub questions) from each module
6. Each full question will have sub questions covering all the topics under a module.
7. The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013- 2nd Edition.
2. Engineering Chemistry, Satyaprakash & Manisha Agrawal, Khanna Book Publishing, Delhi
3. A Text Book of Engg. Chemistry, Shashi Chawla, Dhanpat Rai & Co. (P) Ltd.
4. Essentials of Physical Chemistry, Bahl&Tuli, S.Chand Publishing
5. Applied Chemistry, Sunita Rattan, Kataria 5. Engineering Chemistry, Baskar, Wiley
6. Engineering Chemistry – I, D. Grour Krishana, Vikas Publishing
7. A Text book of Engineering Chemistry, SS Dara & Dr. SS Umare, S Chand & Company Ltd., 12th Edition, 2011.
8. A Text Book of Engineering Chemistry, R.V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.
9. Text Book of Polymer Science, F.W. Billmeyer, John Wiley & Sons, 4th Edition, 1999.
10. Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin & A.C. Arsenault, RSC Publishing, 2005.
11. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996.
12. Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, McGraw Hill, 2019.
13. OLED Display Fundamentals and Applications, Takatoshi Tsujimura, Wiley–Blackwell , 2012
14. Supercapacitors: Materials, Systems, and Applications, Max Lu, Francois Beguin, Elzbieta Frackowiak, Wiley-VCH; 1st edition, 2013.
15. "Handbook on Electroplating with Manufacture of Electrochemicals", ASIA PACIFIC BUSINESS PRESS Inc., 2017. Dr. H. Panda,
16. Expanding the Vision of Sensor Materials. National Research Council 1995, Washington, DC: The National Academies Press. doi: 10.17226/4782.
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Web links and Video Lectures (e-Resources):

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- https://www.youtube.com/watch?v=faESCxAWR9k
- https://www.youtube.com/watch?v=TBqXMWaxZYM&list=PLyhmwFtznRhuz8L1bb3X-9IbHrDMjHWWh
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- https://www.youtube.com/watch?v=X9GHBdyYcyo
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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

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COs and POs Mapping (Individual teacher has to fill up)

	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1				1					
CO2	3	1	1				1					
CO3	3	1	1				1					
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CO5	3	1	1				1					

SHARNBASVA UNIVERSITY

Electrical & Electronics Engineering and Allied branches (Chemistry group)

Course Title:	Chemistry for Electrical and Electronics Engineering stream		
Course Code:	22CHEE12/22	CIE Marks	50
Course Type	(Theory)	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L/T)	3	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Course objectives

- To enable students to acquire knowledge on principles of chemistry for engineering applications.
- To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.
- To provide students with a solid foundation in analytical reasoning required to solve societal problems.

Teaching-Learning Process

These are samples trategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching–Learning more effective

- Flipped class
- Smart class room
- Bended mode of leaning
- Interactive simulations and animation
- Tutorial & remedial classes for needy students (not regular T/R)
- Conducting Makeup classes
- Demonstration of concepts either by building models or by industry visit
- Experiments in laboratories shall be executed in blended mode (conventional or non–conventional methods)
- Use of ICT – Online videos, online courses
- Daily learning through assignments

MODULE 1: Conducting Materials and polymers (8hr)

Conductors and Insulators: Introduction, principle with examples.

Semiconductors: Introduction, production of electronic grade silicon-Czochralski process (CZ) and Float Zone (FZ) methods.

Polymers: Introduction, Molecular weight - Number average, Weight average and numerical problems.Conducting polymers – synthesis and conducting mechanism of polyacetylene. Preparation, properties and commercial applications of graphene oxide.

PCB: Electroless plating – Introduction, Electroless plating of copper in the manufacture of double-sided PCB.

MODULE 2: Battery Technology and Sensors(8hr)

Batteries: Introduction to batteries, construction, working and applications of Ni-MH battery, Lithium ion and Sodium ion batteries.

Fuel Cells: Introduction, construction, working and applications of methanol–oxygen and

1. NOTE: Wherever the contact hours is not sufficient, tutorial hour can be converted to theory hours

polymer electrolyte membrane (PEM) fuel cell. **Sensors:** Introduction, working principle and applications of Conductometric sensors, Electrochemical sensors, Thermometric sensors, and Optical sensors. Sensors for the measurement of dissolved oxygen (DO). Electrochemical gas sensors for SOx and NOx.
MODULE 3: Corrosion Science and Energy Conversion Systems(8hr)
Corrosion Chemistry: Introduction, electrochemical theory of corrosion, types of corrosion-differential metal and differential aeration. Corrosion control - galvanization, anodization and sacrificial anode method. Corrosion Penetration Rate (CPR) - Introduction and numerical problem. **Electrode System:** Introduction, types of electrodes. Ion selective electrode – definition, construction, working and applications of glass electrode. Determination of pH using glass electrode. Reference electrode - Introduction, calomel electrode – construction, working and applications of calomel electrode. Concentration cell– Definition, construction and Numerical problems. **Solar Energy:** Introduction, importance of solar PV cell, construction and working of solar PV cell, advantages and disadvantages.
MODULE 4: Display and Memory Systems (8hr)
Display Systems: Photoactive and electroactive materials, Nanomaterials and organic materials used in optoelectronic devices. Liquid crystals (LC's) - Introduction, classification, properties and application in Liquid Crystal Displays (LCD's). Properties and application of Organic Light Emitting Diodes (OLED's) and Quantum Light Emitting Diodes (QLED's), Light emitting electrochemical cells. **Memory :** Introduction, Basic concepts of electronic memory, History of organic/polymer electronic memory devices, Classification of electronic memory devices, types of organic memory devices (organic molecules, polymeric materials, organic-inorganic hybrid materials).
MODULE 5: Nanomaterials, E-Waste Management and Analytical Techniques (8hr)
Nanomaterials : Introduction, size dependent properties of nanomaterials (surface area, catalytic and electrical), preparation of NPs by sol-gel and precipitation methods **E-Waste:** Introduction, sources of e-waste, Composition, Characteristics, and Need of e-waste management. Toxic materials used in manufacturing electronic and electrical products, health hazards due to exposure to e-waste. Recycling and Recovery: Different approaches of recycling (separation, thermal treatment) **Analytical Techniques:** Introduction, principle and instrumentation of Colorimetric sensors; its application in the estimation of copper, Potentiometric sensors; its application in the estimation of iron.

Course outcome (Course Skill Set) At the end of the course the student will be able to:	
CO1.	Identify the terms and processes involved in scientific and engineering applications
CO2.	Explain the phenomena of chemistry to describe the methods of engineering Processes
CO3.	Solve for the problems in chemistry that are pertinent in engineering applications
CO4.	Apply the basic concepts of chemistry to explain the chemical properties and processes
CO5.	Analyze properties and processes associated with chemical substances in multidisciplinary situations

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 45% of the maximum marks (23 marks out of 50). The minimum passing marks for the SEE is 35% of the maximum marks (18 marks out of 50).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum and total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

The CIE shall be conducted by the course teacher throughout the semester. The suggested components of CIE for Theory course are

The CIE marks for the theory component shall be 50 marks is as detailed below

- Three Tests each of 15 Marks; (Third test is improvement test).
- CIE will be conducted by the university as per scheduled time table with question papers for the subject (duration of 1 hour 15 minutes)
- Session wise assignments for 25 marks
- For Seminar and library work 05 marks
- Attendance 5 marks (95% to 100%), 04 marks (85% to 94%)

Semester End Examination (SEE)

1. Theory SEE will be conducted by University as per the scheduled time table, with question papers for the subject **(duration 03 hours)**
2. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50 marks.
3. The question paper will have ten full questions carrying equal marks.
4. Each full question carries 20 marks.
5. There will be two full questions (with a maximum of three sub questions) from each module
6. Each full question will have sub questions covering all the topics under a module.
7. The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

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4. Essentials of Physical Chemistry, Bahl&Tuli, S.Chand Publishing
5. Applied Chemistry, Sunita Rattan, Kataria 5. Engineering Chemistry, Baskar, Wiley
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- https://www.youtube.com/watch?v=faESCxAWR9k
- https://www.youtube.com/watch?v=TBqXMWaxZYM&list=PLyhmwFtznRhuz8L1bb3X-9IbHrDMjHWWh
- https://www.youtube.com/watch?v=j5Hml6KN4TI
- https://www.youtube.com/watch?v=X9GHBdyYcyo
- https://www.youtube.com/watch?v=1xWBPZnEJk8
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COs and POs Mapping (Individual teacher has to fill up)

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CO5	3	1	1				1					

SHARNBASVA UNIVERSITY
Engineering Chemistry Lab

Course Title:	Engineering Chemistry Lab (Common for all Branches /Streams)		
Course Code:	22CHEL18/28	CIE Marks	50
Course Type	(Practical)	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (Practical)	2	Exam Hours	02
Total Hours of Pedagogy	38 hours	Credits	01

Course Objectives:

- To provide students with practical knowledge of
- Quantitative analysis of materials by classical methods of analysis.
- Instrumental methods for developing experimental skills in building technicalcompetence.

Instrumental Experiments

1. Potentiometric estimation of FAS using standard $K_2Cr_2O_7$ solution.
2. Conductometric estimation of acid mixture.
3. Determination of Viscosity co-efficient of the given liquid using Ostwald's viscometer.
4. Colorimetric estimation of estimation of copper.
5. Determination of pKa of the given weak acid using pH meter.

Volumetric Experiments

1. Estimation of total hardness of water by EDTA complexometric method.
2. Estimation of CaO in cement solution by rapid EDTA method.
3. Determination of percentage of Copper in brass using standard sodium thiosulphatesolution.
4. Determination of COD of waste water.
5. Estimation of Iron in haematite ore solution using standard $K_2Cr_2O_7$ solution by externalindicator method.

Demonstration Experiments

1. Synthesis of nanomaterials by precipitation method.

2. Determination of percentage of chlorine in bleaching powder by lodometric method

Course outcomes:

On completion of this course, students will have the knowledge in,

CO1: Principles and procedure.(Knowledge)

CO2: Understanding the reactions.(Comprehension)

CO3: Applications

CO 4: Handling different types of instruments for analysis of materials using small quantities ofmaterials involved for quick and accurate results (Analysis)

CO5: Carrying out different types of titrations for estimation of concerned in materials using comparatively more quantities of materials involved for good results (Synthesis)

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 45% of the maximum marks (23 marks out of 50). The minimum passing marks for the SEE is 35% of the maximum marks (18 marks out of 50).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum and total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the practical component

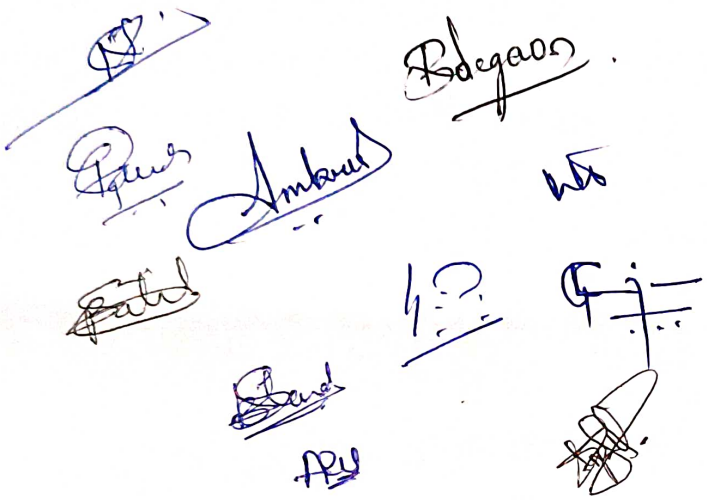
- On completion of every experiment in the laboratory, the students shall be evaluated and marks shall be awarded on the same day.
- The 25 marks are for conducting the experiment and preparation of the laboratory record,10 marks for individual evaluation (which includes viva voce), (the average of total experiments}
- The 15 marks shall be for the test conducted at the end of the semester, for the subject (duration of 1 hour 15 minutes)

SEE for the practical component

- SEE marks for the practical course is 50 marks
- All laboratory experiments are to be included for the practical exam
- Break up marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners
- Students can pick one question (experiment) from the questions lot prepared by the examiners
- General rubrics suggested for SEE are mentioned here write up 15%, conduction procedure and resulst is 70% and viva voce 10% of maximum marks.
- Practical SEE will be conducted by University as per the scheduled time table, for the subject **(duration 02 hours)**

Reference Books:

1. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, "Vogel's A I, Text Book ofQuantitative analysis, Dorling Kindersley (Idia) Pvt. Ltd. 35th Edition 2012.
2. O.P. Vermani & Narula, "Theory and Practice in Applied Chemistry", New Age InternationalPublishers.
3. Gary D. Christian, "Analytical chemistry", 6th Edition, Wiley India.2015



SHARNBASVA UNIVERSITY

Civil Engineering and Allied branches
(Chemistry group)

Course Title:	Applied Chemistry for Civil Engineering Stream		
Course Code:	22CHEC12/22	CIE Marks	50
Course Type	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L/T)	3	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Course objectives

- To enable students to acquire knowledge on principles of chemistry for engineering applications.
- To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.
- To provide students with a solid foundation in analytical reasoning required to solve societal problems.

Teaching-Learning Process

Teaching-Learning Process

These are samples trategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching–Learning more effective

- Flipped class
- Smart class room
- Bended mode of leaning
- Interactive simulations and animation
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- Conducting Makeup classes
- Demonstration of concepts either by building models or by industry visit
- Experiments in laboratories shall be executed in blended mode (conventional or non–conventional methods)
- Use of ICT – Online videos, online courses
- Daily learning through assignments

Module-1: Structural Materials (8 hr)

Metals and Alloys: Introduction, Properties and application of Iron and its alloys,

Cement: Introduction, composition, properties, classification, manufacturing process of cement, process of setting and hardening of cement, additives for cement and testing of cement.

Refractories: Introduction, classification based on chemical composition, properties and application of refractory materials (clay bricks. silicon bricks, casting materials)

Glass: Introduction, Composition, Types, Preparation of Soda-lime glass, properties and applications of Soda-lime glass.

Module-2: Energy Conversion Systems and Corrosion (8 hr)

Energy conversion: Fuel Cells: Introduction, construction, working and applications of methanol–oxygen and polymer electrolyte membrane (PEM) fuel cell.

Storage devices: Introduction, construction and working of Li-ion battery.

1. NOTE: Wherever the contact hours is not sufficient, tutorial hour can be converted to theory hours

Corrosion: Introduction, electrochemical corrosion of steel in concrete, types (differential metal and aeration), Stress corrosion in civil structures, corrosion control (design and selection of materials, galvanization, anodization and sacrificial anode method).
Module-3: Nanotechnology and Water Technology (8 hr)
Nanotechnology: Introduction, size dependent properties of nanomaterial (surface area and catalytic), Synthesis of nanomaterial by sol-gel method and precipitation method. **Nanomaterials:** Introduction, properties and engineering applications of carbon nanotubes, graphene and nanomaterials for water treatment (Metal oxide). **Water technology:** Introduction, water parameters, hardness of water, determination of temporary, permanent and total hardness by EDTA method, numerical problems, softening of water by ion exchange method, desalination of water by reverse osmosis, determination ofCOD, numerical problems.
Module-4:Polymer and Composites (8 hr)
Polymer: Introduction, type of polymerization with examples (Addition and condensation), molecular weight of polymers, numerical problems. Synthesis, properties and engineering applications of polyethylene (PE) and polyvinyl chloride (PVC). **Fibers and composites**: Synthesis, properties and applications of Kevlar and nylon fibers. **Adhesives**: Introduction, properties and applications of epoxy resin. **Biodegradable polymers**: Synthesis of polylactic acid (PLA) and their applications.
Module-5:Phase Rule and Analytical Techniques (8 hr)
Phase rule: Introduction, Definition of terms: phase, components, degree of freedom, phase rule equation. Phase diagram: One component (water system) . **Analytical techniques**: Introduction, principle, instrumentation of potentiometric sensors; its application in the estimation of iron, Optical sensors (colorimetry); its application in the estimation of the copper, pH-sensor (Glass electrode); its application in the determination of pH of beverages.
Course outcome (Course Skill Set) At the end of the course the student will be able to:

CO1.	Identify the terms and Processes involved in scientific and engineering applications
CO2.	Explain the phenomena of chemistry to describe the methods of engineering processes
CO3.	Solve for the problems in chemistry that are pertinent in engineering applications
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- Attendance 5 marks (95% to 100%), 04 marks (85% to 94%)

Semester End Examination (SEE)

1. Theory SEE will be conducted by University as per the scheduled time table, with question papers for the subject **(duration 03 hours)**
2. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50 marks.
3. The question paper will have ten full questions carrying equal marks.
4. Each full question carries 20 marks.
5. There will be two full questions (with a maximum of three sub questions) from each module
6. Each full question will have sub questions covering all the topics under a module.
7. The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:

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5. Applied Chemistry, Sunita Rattan, Kataria 5. Engineering Chemistry, Baskar, Wiley
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- https://www.youtube.com/watch?v=TBqXMWaxZYM&list=PLyhmwFtznRhuz8L1bb3X-9IbHrDMjHWWh
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CO5	3	1	1				1					

SHARNBASVA UNIVERSITY

Computer Science and Engineering and allied branches (Chemistry group)

Course Title:	Applied Chemistry for Computer Science & Engineering stream		
Course Code:	22CHES12/22	CIE Marks	50
Course Type	(Theory)	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L/T)	3	Exam Hours	3
Total Hours of Pedagogy	40 hours	Credits	3

Course objectives

- To enable students to acquire knowledge on principles of chemistry for engineering applications.
- To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.
- To provide students with a solid foundation in analytical reasoning required to solve societal problems.

Teaching-Learning Process

These are samples trategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching–Learning more effective

- Flipped class
- Smart class room
- Bended mode of leaning
- Interactive simulations and animation
- Tutorial & remedial classes for needy students (not regular T/R)
- Conducting Makeup classes
- Demonstration of concepts either by building models or by industry visit
- Experiments in laboratories shall be executed in blended mode (conventional or non–conventional methods)
- Use of ICT – Online videos, online courses
- Daily learning through assignments

MODULE 1: Energy Storage Systems and Sensors (8hr)

Energy Storage Systems: Introduction to batteries, construction, working and applications of Ni-MH battery, Lithium ion and Sodium ion batteries.

Sensors: Introduction, working principle and applications of Conductometric sensors, Electrochemical sensors, Thermometric sensors, and Optical sensors. Sensors for the measurement of dissolved oxygen (DO). Electrochemical gas sensors for SOx and NOx.

MODULE 2: Display and Memory Systems (8hr)

Display Systems: Photoactive and electroactive materials, Nanomaterials and organic materials used in optoelectronic devices. Liquid crystals (LC's) - Introduction, classification, properties and application in Liquid Crystal Displays (LCD's). Properties and application of Organic Light Emitting Diodes (OLED's) and Quantum Light Emitting Diodes (QLED's), Light emitting electrochemical cells.

Memory : Introduction, Basic concepts of electronic memory, History of organic/polymer electronic memory devices, Classification of electronic memory devices,

1. NOTE: Wherever the contact hours is not sufficient, tutorial hour can be converted to theory hours

types of organic memory devices (organic molecules, polymeric materials, organic-inorganic hybrid materials).
MODULE 3: Electrode System and Corrosion(8hr)
Corrosion Chemistry: Introduction, electrochemical theory of corrosion, types of corrosion-differential metal and differential aeration. Corrosion control - galvanization, anodization and sacrificial anode method. Corrosion Penetration Rate (CPR) - Introduction and numerical problem. **Electrode System:** Introduction, types of electrodes. Ion selective electrode – definition, construction, working and applications of glass electrode. Determination of pH using glass electrode. Reference electrode - Introduction, calomel electrode – construction, working and applications of calomel electrode. Concentration cell– Definition, construction and Numerical problems.
MODULE 4: Green Fuels and Polymers (8hr)
Green Fuels: Introduction, construction and working of solar photovoltaic cell, advantages, and disadvantages. Generation of energy (green hydrogen) by electrolysis of water and its advantages. **Polymers:** Introduction, Molecular weight - Number average, weight average and numerical problems. Conducting polymers – synthesis and conducting mechanism of polyacetylene and commercial applications. Preparation, properties, and commercial applications of graphene oxide.
MODULE 5: Analytical Techniques and E-Waste Management (8hr)
Analytical Techniques: Introduction, principle and instrumentation of Conductometry; its application in the estimation of weak acid. Potentiometry; its application in the estimation of iron. **E-Waste:** Introduction, sources of e-waste, Composition, Characteristics, and Need of e-waste management. Toxic materials used in manufacturing electronic and electrical products, health hazards due to exposure to e-waste. Recycling and Recovery: Different approaches of recycling (separation, thermal treatment)

Course outcome (Course Skill Set) At the end of the course the student will be able to:	
CO1.	Identify the terms and processes involved in scientific and engineering Applications
CO2.	Explain the phenomena of chemistry to describe the methods of engineering processes
CO3.	Solve for the problems in chemistry that are pertinent in engineering applications
CO4.	Apply the basic concepts of chemistry to explain the chemical properties and processes
CO5.	Analyze properties and Processes associated with chemical substances in multidisciplinary situations

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 45% of the maximum marks (23 marks out of 50). The minimum passing marks for the SEE is 35% of the maximum marks (18 marks out of 50).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum and total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

The CIE shall be conducted by the course teacher throughout the semester. The suggested components of CIE for Theory course are

The CIE marks for the theory component shall be 50 marks is as detailed below

- Three Tests each of 15 Marks; (Third test is improvement test).
- CIE will be conducted by the university as per scheduled time table with question papers for the subject (duration of 1 hour 15 minutes)
- Session wise assignments for 25 marks
- For Seminar and library work 05 marks
- Attendance 5 marks (95% to 100%), 04 marks (85% to 94%)

Semester End Examination (SEE)

1. Theory SEE will be conducted by University as per the scheduled time table, with question papers for the subject **(duration 03 hours)**
2. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50 marks.
3. The question paper will have ten full questions carrying equal marks.
4. Each full question carries 20 marks.
5. There will be two full questions (with a maximum of three sub questions) from each module
6. Each full question will have sub questions covering all the topics under a module.
7. The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013- 2nd Edition.
2. Engineering Chemistry, Satyaprakash & Manisha Agrawal, Khanna Book Publishing, Delhi
3. A Text Book of Engg. Chemistry, Shashi Chawla, Dhanpat Rai & Co. (P) Ltd.
4. Essentials of Physical Chemistry, Bahl&Tuli, S.Chand Publishing
5. Applied Chemistry, Sunita Rattan, Kataria 5. Engineering Chemistry, Baskar, Wiley
6. Engineering Chemistry – I, D. Grour Krishana, Vikas Publishing
7. A Text book of Engineering Chemistry, SS Dara & Dr. SS Umare, S Chand & Company Ltd., 12th Edition, 2011.
8. A Text Book of Engineering Chemistry, R.V. Gadag and Nityananda Shetty, I. K. International Publishing house. 2nd Edition, 2016.
9. Text Book of Polymer Science, F.W. Billmeyer, John Wiley & Sons, 4th Edition, 1999.
10. Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin & A.C. Arsenault, RSC Publishing, 2005.
11. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996.
12. Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, McGraw Hill, 2019.
13. OLED Display Fundamentals and Applications, Takatoshi Tsujimura, Wiley–Blackwell , 2012
14. Supercapacitors: Materials, Systems, and Applications, Max Lu, Francois Beguin, Elzbieta Frackowiak, Wiley-VCH; 1st edition, 2013.
15. "Handbook on Electroplating with Manufacture of Electrochemicals", ASIA PACIFIC BUSINESS PRESS Inc., 2017. Dr. H. Panda,
16. Expanding the Vision of Sensor Materials. National Research Council 1995, Washington, DC: The National Academies Press. doi: 10.17226/4782.
17. Engineering Chemistry, Edited by Dr. Mahesh B and Dr. Roopashree B, Sunstar Publisher, Bengaluru, ISBN 978-93-85155-70-3, 2022
18. High Performance Metallic Materials for Cost Sensitive Applications, F. H. Froes, et al. John Wiley & Sons, 2010
19. Instrumental Methods of Analysis, Dr. K. R. Mahadik and Dr. L. Sathiyanarayanan, Nirali Prakashan, 2020
20. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, Cengage Learning, 2020
21. Polymer Science, V R Gowariker, N V Viswanathan, Jayadev, Sreedhar, Newage Int. Publishers, 4th Edition, 2021
22. Engineering Chemistry, P C Jain & Monica Jain, Dhanpat Rai Publication, 2015-16th Edition.
23. Nanostructured materials and nanotechnology, Hari Singh, Nalwa, academic press, 1st Edition, 2002.
24. Nanotechnology Principles and Practices, Sulabha K Kulkarni, Capital Publishing Company, 3rd Edition 2014
25. Principles of nanotechnology, Phanikumar, Scitech publications, 2nd Edition, 2010.
26. Chemistry for Engineering Students, B. S. Jai Prakash, R. Venugopal, Sivakumaraiah & Pushpa Iyengar., Subash Publications, 5th Edition, 2014
27. "Engineering Chemistry", O. G. Palanna, Tata McGraw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015.
28. Chemistry of Engineering materials, Malini S, K S Anantha Raju, CBS publishers Pvt Ltd.,
29. Laboratory Manual Engg. Chemistry, Anupma Rajput, Dhanpat Rai & Co.

Web links and Video Lectures (e-Resources):

- http://libgen.rs/
- https://nptel.ac.in/downloads/122101001/
- https://nptel.ac.in/courses/104/103/104103019/
- https://ndl.iitkgp.ac.in/
- https://www.youtube.com/watch?v=faESCxAWR9k
- https://www.youtube.com/watch?v=TBqXMWaxZYM&list=PLyhmwFtznRhuz8L1bb3X-9IbHrDMjHWWh
- https://www.youtube.com/watch?v=j5Hml6KN4TI
- https://www.youtube.com/watch?v=X9GHBdyYcyo
- https://www.youtube.com/watch?v=1xWBPZnEJk8
- https://www.youtube.com/watch?v=wRAo-M8xBHM

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- https://www.vlab.co.in/broad-area-chemical-sciences
- https://demonstrations.wolfram.com/topics.php
- https://interestingengineering.com/science

COs and POs Mapping (Individual teacher has to fill up)

	PO											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1				1					
CO2	3	1	1				1					
CO3	3	1	1				1					
CO4	3	1	1				1					
CO5	3	1	1				1					

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UGC Status: Letter No. F.8-29/2017(CPP-I/PU), Dated 20 Dec. 2017. Enlisted by the University Grants Commission, New Delhi, in the list of Private Universities in India.
A Private University enacted by Govt. of Karnataka as "Sharnbasva University Act, 2012" Karnataka Act No. 17 of 2013. Notification No. ED 144 URC 2016 dated 29/07/2017

Ref No: **Date: 08-11-2022**

DEPARTMENT OF CHEMISTRY BOARD OF STUDIES(BOS) MEETING

Proceeding of BOS Department of Chemistry was held on 08.11.2022 at 11:00 am in the Department of Chemistry B.Tech (Co-ed) building, Sharnbasva University.

AGENDA OF THE MEETING

1. Approval of syllabus and Question paper pattern of B.Tech. Engineering Chemistry for CES, CSS, MES and EES Streams as per NEP-2020 scheme for the academic year 2022-23 and 2023-24
2. Approval of syllabus and Question paper pattern of B.Tech. Engineering Chemistry Lab is common for all CES, CSS, MES and EES Streams as per NEP-2020 scheme for the academic year 2022-23 and 2023-24

MINUTES OF THE MEETING

1. Proceeding of the meeting of the board of studies in chemistry held on 8th Nov 2022 at 11:00 am to prepare the syllabus and Question paper pattern of B.Tech. Engineering Chemistry, Choice Based Credit System (CBCS), Outcome Based Education (OBE) and as per National Education Policy (NEP) for the academic year 2022-23 and 2023-24

2. The syllabus and Question paper pattern of B.Tech. Engineering Chemistry was drafted after several deliberation and discussion during the meeting of the board of studies, it was decided and prepared the syllabus as chemistry for Civil Engineering stream(CES), chemistry for Computer Science stream(CSS), chemistry for Mechanical Engineering stream(MES) and chemistry for Electrical and Electronics Engineering stream(EES).

3. For Engineering Chemistry Lab, it was decided by all the BOS members that, all experiments should be common to all Streams/Branches. All laboratory experiments are to be included for the practical exam. Practical SEE will be conducted by University as per the scheduled time table, for the subject (duration 02 hours). Students can perform one experiment from the questions lot prepared by the examiners

RESOLUTIONS

1. The BOS Members approved scheme, syllabus and Question paper pattern of B.Tech. Engineering Chemistry for CES, CSS, MES and EES Streams as per NEP-2020 scheme for the academic year 2022-23 and 2023-24.

2. The BOS Members approved scheme, syllabus and Question paper pattern of B.Tech. Engineering Chemistry Lab is common for all CES, CSS, MES and EES Streams as per NEP-2020 scheme for the academic year 2022-23 and 2023-24,

The Following Members were attended the meeting approved the Scheme, Syllabus and Pattern of Question paper.

SI. NO.	NAME OF THE FACULTY	DESIGNATION	SIGNATURE
1	**Dr. Nirdosh Patil**	**Chairman**	
2	**Dr. Parvati G**	Member	
3	**Dr. Shweta Patil**	Member	
4	**Prof. Anita R H**	Member	
5.	**Prof. Sangeeta Aland**	Member	
6	**Dr. R. S Malipatil**	Member	
7	**Dr. Kashinath K**	Member	
8	**Dr. Shivakumar R**	Member	
9	**Prof. Siddangouda Patil**	Member	

CHAIRMAN

Sharnbasva University, Kalaburagi

Scheme for B.Tech., First Year Program from the Academic Year: 2022-23

All the B.Tech., branches offered by the University are grouped in to Four Streams (CES, MES, EES and CSS)

B.Tech. First semester

Sl. No.	Course	Course Code	Course Title	Teaching Department/ Paper Setting Board	Teaching hours/week				Examination				Credits
					Theory/ Lecture	Tutorial	Practical/ Drawing	Activities	Duration	CIE Marks	SEE Marks	Total Marks	
1	ASC (IC)	22MATC11	Mathematics for CES - I	Mathematics	3		2	0	3+2	50	50	100	4
		22MATM11	Mathematics for MES - I		3		2	0	3+2	50	50	100	4
		22MATE11	Mathematics for EES - I		3		2	0	3+2	50	50	100	4
		22MATS11	Mathematics for CSS - I		3		2	0	3+2	50	50	100	4

B.Tech. Second semester

2	ASC (IC)	22MATC21	Mathematics for CES - II	Mathematics	3		2	0	3+2	50	50	100	4
		22MATM21	Mathematics for MES - II		3		2	0	3+2	50	50	100	4
		22MATE21	Mathematics for EES - II		3		2	0	3+2	50	50	100	4
		22MATS21	Mathematics for CSS - II		3		2	0	3+2	50	50	100	4

CES	Civil Engineering Sream	CIVIL
MES	Mechanical Engineering Stream	MECH, ENERGY
EES	Electrical and Electronics Engineering Stream	EEE, ECE
CSS	Computer science Engineering Stream	CSE, AI&DS and AI&ML

Sharnbasva University, Kalaburagi

Scheme for B.Tech., Second Year Program from the Academic Year: 2022-23

All the B.Tech., branches offered by the University are grouped in to Four Streams (CES, MES, EES and CSS)

B.Tech. Third and Fourth semester Lateral Entry students

Sl. No.	Course	Course Code	Course Title	Teaching Department/ Paper Setting Board	Teaching hours/week				Examination				Credits
					Theory/ Lecture	Tutorial	Practical/ Drawing	Activities	Duration	CIE Marks	SEE Marks	Total Marks	
I		22MATDIP31	Additional Mathematics - I	Mathematics	2		0	0	2	50	0	100	0
		22MATDIP41	Additional Mathematics - II		2		0	0	2	50	0	100	0

Course Title:	Mathematics for Civil Engineering Stream		
Course Code:	22MATC11	CIE Marks	50
Course Type(Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P:S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40hoursTheory+10-12Lab slots	Credits	04

Course objectives: The goal of the course Advanced Calculus, Transforms and Numerical methods (22MATC11) is to

- Familiarize the importance of series expansion and Vector calculus essential for civil engineering.
- Analyze Civil engineering problems applying Partial derivatives and understand the value of limit (continuity) of function by using indeterminate forms.
- Develop the knowledge of polar curves to trace different types of curves.
- Applications of first order first degree differential equations.
- To develop the knowledge of matrices and linear algebra in a comprehensive manner.

Teaching-Learning Process
Pedagogy(General Instructions):
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework and quizzes, and documenting students' progress.
5. Five assignment problems on each module.
6. Encourage the students for group learning to improve their creative and analytical skills.
7. Show short related video lectures in the following ways:
    - As an introduction to new topics (pre-lecture activity).
    - As a revision of topics (post-lecture activity).
    - As additional examples (post-lecture activity).
    - As an additional material of challenging topics (pre-and post-lecture activity).
    - As a model solution of some exercises (post-lecture activity).

Course outcome (Course Skill Set)
At the end of the course the student will be able to:

CO1	Learn the notion of partial differentiation to compute rate of change multivariate functions and understand the concept of Indeterminate forms.
CO2	Illustrate the applications of multivariate calculus to understand the solenoidal and irrotational vectors and know the expansions of functions in power series form.
CO3	Apply the knowledge of calculus to solve problems related to polar curves and graphical representation of different curves.
CO4	Solve first order linear/nonlinear differential equation analytically using standard methods and express the solution in graphical form.
CO5	Make use of matrix theory for solving for system of linear equations and compute Eigen values and Eigen vectors by using computational software's.
CO6	Learn with modern mathematical tools namely SCILAB /PYTHON /MATLAB /

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√			
CO2	√	√	√			
CO3	√	√	√			
CO4	√	√	√			
CO5	√	√	√			

Course Articulation Matrix / Course mapping :

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

Note: 1-Low mapped, 2-Medium mapped, 3-High mapped

MODULE-1 : INDETERMINATE FORMS AND PARTIAL DIFFERENTIATION

Introduction to Indeterminate forms and Partial differentiation relating to Civil Engineering.
Indeterminate forms - L'Hospital's rule. Problems.
Partial differentiation, total derivative - differentiation of composite functions. Jacobian and problems. Maxima and minima for a function of two variables. Problems.
Self study: Euler's theorem and problems. Method of Lagrange's undetermined multipliers with single constraint.
Applications: Computation of stress and strain, Errors and approximations, Estimating the critical points and extreme values.
(RBT Levels: L1, L2 and L3)

(8 Hours)

MODULE-2 : SERIES EXPANSION AND VECTOR CALCULUS

Introduction to Series expansion and Vector Calculus in Civil Engineering applications.
Taylor's and Maclaurin's series expansions for one variable (statements only)- Problems

Vector Differentiation: Scalar and vector fields. Gradient, directional derivative, divergence and curl - physical interpretation, solenoidal and irrotational vector fields. Problems.

Self-Study: Velocity and acceleration of a moving particle.
Applications: Heat and mass transfer, oil refinery problems, environmental engineering.

(RBT Levels: L1, L2 and L3)

(8 Hours)

MODULE-3: DIFFERENTIAL CALCULUS

Introduction to polar coordinates and curvature in Civil Engineering applications.

Polar coordinates, Polar curves, angle between the radius vector and tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature - Cartesian, Parametric, Polar and Pedal forms. Problems.

Self-study: Center and circle of curvature, evolutes, involutes and envelopes.
Applications: Angle of elevation and survey engineering.
(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE- 4: LINEAR AND NON-LINEAR ORDINARY DIFFERENTIAL EQUATION OF FIRST ORDER

Introduction to first order ordinary differential equations pertaining to the applications for Civil engineering.
Exact and reducible to exact differential equations -Integrating factors type-1.
Applications of ODE's – Orthogonal trajectories, Conduction of heat, Newton's law of cooling.
Problems.

Self-Study: Applications of ODE's, Solvable for x ,y and p.

Applications of ordinary differential equations: Rate of Decay and growth.
(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE- 5: LINEAR ALGEBRA

Introduction of liner algebra related to Civil Engineering applications.
Elementary row transformation of a matrix, Rank of a matrix. Consistency and solution of a system of linear equations - Gauss-Jordan method and approximate solution by Gauss-Seidel method. Eigen values and Eigen vectors, Rayleigh's power method to find the dominant Eigen value and Eigen vector.

Self-Study: Solution of a system of linear equations by Gauss-Jacobi iterative method, Gauss-elimination method. Inverse of a square matrix by Cayley-Hamilton theorem.
Applications of Linear Algebra: Optimum solution.
(RBT Levels: L1, L2 and L3) (8 Hours)

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1	Finding the sum of the series up to infinity
2	Finding the given series convergent and divergent
3	Evaluating the limits
4	Finding the Partial derivatives of a given function Finding partial derivatives, Jacobian and plotting the graph
5	Applications to Maxima and Minima of two variables
6	2D plots for Cartesian and polar curves Finding of intersection between two polar curves
7	Finding the angle between the radius vector and the tangent
8	Finding the pedal equation of the polar curves
9	Finding radius of curvature of a given curve
10	Solution of first order differential equation and plotting the graphs
11	Program to compute area, volume and centre of gravity
12	Solving the Linear differential equations

13	Evaluating the rank of matrix
14	Numerical solution of system linear equations , test for consistency .

Suggested software's : Mathematica/MatLab/Python/Scilab

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 45% of the maximum marks (22.5 marks out of 50). The minimum passing marks for the SEE is 35% of the maximum marks (18 marks out of 50).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

The CIE shall be conducted by the course teacher throughout the semester. The CIE marks for the theory component of the IC shall be 30 marks and for the laboratory component 20 Marks.

The CIE marks for the theory component shall be 50 marks and scored will be reduced to 30.As below

- Three Tests each of 15 Marks; after the completion of the syllabus of 35-40%, 65-70%, and 90-100% respectively. Average of Best Two performances of the Internal Tests shall be considered for 15 Marks.
- Session wise assignments for 25 marks
- For Seminar and library work 05 marks
- Attendance 5 marks (95% to 100%), 04 marks (85% to 94%)

CIE for the practical component of the IC:

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The 35 marks are for conducting the experiment and preparation of the laboratory record, the other 15 marks shall be for the test conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 50 marks. Marks of all experiments' write-ups are added and scaled down to 20 marks.

Semester End Examination(SEE)

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question carries 20 marks.
4. There will be two full questions (with a maximum of three sub questions) from each module
5. Each full question will have sub questions covering all the topics under a module.
6. The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)Text Books

1. **B.S.Grewal:**"Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
2. **E. Kreyszig:** "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

Reference Books

1. **V.Ramana:**"Higher Engineering Mathematics" McGraw-Hill Education,11th Ed.,2017
2. **Srimanta Pal & Subodh C. Bhunia:** "Engineering Mathematics" Oxford University Press, 3rdEd., 2016.
3. **N.PBali and Manish Goyal:** "A textbook of Engineering Mathematics" Laxmi Publications,10th Ed.,2022.
4. **C.Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw–Hill Book Co., New york, 6thEd., 2017.
5. **C.B Gupta, S. R Singh and Mukesh Kumar:** "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education (India) Pvt.Ltd 2015.
6. **H.K.Dass and Er.Rajnish Verma:** "Higher Engineering Mathematics" S.Chand Publication, 3rdEd., 2014.
7. **James Stewart:** "Calculus" Cengage Publications, 7thEd., 2019.
8. **David CLay:** "Linear Algebra and its Applications", Pearson Publishers, 4th Ed.,2018.
9. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6thEd., 2017.

Course Title:	Mathematics for Mechanical Engineering Stream		
Course Code:	22MATM11	CIE Marks	50
Course Type(Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P:S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40hoursTheory+10-12Lab slots	Credits	04

Course objectives: The goal of the course Advanced Calculus, Transforms and Numerical methods (22MATM11) is to

- Familiarize the importance of series expansion and Vector calculus essential for Mechanical engineering.
- Analyze Mechanical engineering problems applying Partial Derivatives and understand the value of limit (continuity) of function by using indeterminate forms.
- Develop the knowledge of polar curves to trace different types of curves.
- Applications of first order first degree differential equations.
- To develop the knowledge of matrices and linear algebra in a comprehensive manner.

Teaching-Learning Process

Pedagogy(General Instructions):

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5. Five assignment problems on each module.
6. Encourage the students for group learning to improve their creative and analytical skills.
7. Show short related video lectures in the following ways:
    - As an introduction to new topics (pre-lecture activity).
    - As a revision of topics (post-lecture activity).
    - As additional examples (post-lecture activity).
    - As an additional material of challenging topics (pre-and post-lecture activity).
    - As a model solution of some exercises (post-lecture activity).

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1	Learn the notion of partial differentiation to compute rate of change multivariate functions and understand the concept of Indeterminate forms.
CO2	Illustrate the applications of multivariate calculus to understand the solenoidal and irrotational vectors and know the expansions of functions in power series form.
CO3	Apply the knowledge of calculus to solve problems related to polar curves and graphical representation of different curves.
CO4	Solve first order linear/nonlinear differential equation analytically using standard methods and express the solution in graphical form.
CO5	Make use of matrix theory for solving for system of linear equations and

	CO6	Learn with modern mathematical tools namely SCILAB /PYTHON /MATLAB / MATHEMATICA	

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√			
CO2	√	√	√			
CO3	√	√	√			
CO4	√	√	√			
CO5	√	√	√			

Course Articulation Matrix / Course mapping :

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

Note: 1-Low mapped, 2-Medium mapped, 3-High mapped

MODULE-1 : INDETERMINATE FORMS AND PARTIAL DIFFERENTIATION

Introduction to Indeterminate forms and Partial differentiation relating to Mechanical Engineering.

Indeterminate forms - L'Hospital's rule. Problems.

Partial differentiation, total derivative - differentiation of composite functions. Jacobian and problems. Maxima and minima for a function of two variables. Problems.

Self study: Euler's theorem and problems. Method of Lagrange's undetermined multipliers with a single constraint.

Applications: Computation of stress and strain, Errors and approximations in manufacturing process, Estimating the critical points and extreme values, vector calculus.

(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE-2 : SERIES EXPANSION AND VECTOR CALCULUS

Introduction to Series expansion and Vector Calculus in Mechanical Engineering applications.

Taylor's and Maclaurin's series expansions for one variable (statements only)- Problems

Vector Differentiation: Scalar and vector fields. Gradient, directional derivative, divergence and curl - physical interpretation, Solenoidal and rrotational vector fields and Problems.

Self-Study: Volume integral and Gauss divergence theorem.

Applications: Heat and mass transfer, oil refinery problems, environmental engineering. Analysis of stream lines, velocity and acceleration of a moving particle.

(RBT Levels: L1, L2 and L3) (8 Hours)

08-01-23

MODULE-3: DIFFERENTIAL CALCULUS

Introduction of series expansion and partial differentiation in Mechanical Engineering applications.

Polar coordinates, Polar curves, angle between the radius vector and tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature - Cartesian, Parametric, Polar and Pedal forms, only problems.

Self-study: Center and circle of curvature, evolutes, involutes and envelopes.
Applications: Computer graphics, Image processing.
(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE- 4: LINEAR AND NON-LINEAR ORDINARY DIFFERENTIAL EQUATION OF FIRST ORDER

Introduction to first order ordinary differential equations pertaining to the applications for Mechanical Engineering.

Exact and reducible to exact differential equations -Integrating factors type-1, linear and reducible linear. Applications of ODE's – Orthogonal trajectories, Conduction of heat, Newton's law of cooling. Problems.

Self-Study: Applications of ODE's, Solvable for x, y and p. Clairaut's form.

Applications : Rate of Decay and growth and applications to Mechanical Engineering.
(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE- 5: LINEAR ALGEBRA

Introduction of linear algebra related to Mechanical Engineering applications.

Elementary row transformation of a matrix, Rank of a matrix. Consistency and solution of a system of linear equations - Gauss-Jordan method and approximate solution by Gauss-Seidel method. Eigen values and Eigen vectors, Rayleigh's power method to find the dominant Eigen value and Eigen vector.

Self-Study: Solution of a system of linear equations by Gauss-Jacobi iterative method, Gauss-elimination method. Inverse of a square matrix by Cayley-Hamilton theorem.
Applications : Network Analysis, Markov Analysis, Critical point of a network system. Optimum solution.
(RBT Levels: L1, L2 and L3) (8 Hours)

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1	Finding the sum of the series up to infinity
2	Finding the given series convergent and divergent
3	Evaluating the limits
4	Finding the Partial derivatives of a given function Finding partial derivatives, Jacobian and plotting the graph
5	Applications to Maxima and Minima of two variables
6	2D plots for Cartesian and polar curves Finding of intersection between two polar curves
7	Finding the angle between the radius vector and the tangent
8	Finding the pedal equation of the polar curves
9	Finding radius of curvature of a given curve
10	Solution of first order differential equation and plotting the graphs

11	Program to compute area, volume and centre of gravity
12	Solving the Linear differential equations
13	Evaluating the rank of matrix
14	Numerical solution of system linear equations , test for consistency .

Suggested software's : Mathematica/MatLab/Python/Scilab

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 45% of the maximum marks (22.5 marks out of 50). The minimum passing marks for the SEE is 35% of the maximum marks (18 marks out of 50).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

The CIE shall be conducted by the course teacher throughout the semester. The CIE marks for the theory component of the IC shall be 30 marks and for the laboratory component 20 Marks.

The CIE marks for the theory component shall be 50 marks and scored will be reduced to 30.As below

- Three Tests each of 15 Marks; after the completion of the syllabus of 35-40%, 65-70%, and 90-100% respectively. Average of Best Two performances of the Internal Tests shall be considered for 15 Marks.
- Session wise assignments for 25 marks
- For Seminar and library work 05 marks
- Attendance 5 marks (95% to 100%), 04 marks (85% to 94%)

CIE for the practical component of the IC:

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The 35 marks are for conducting the experiment and preparation of the laboratory record, the other 15 marks shall be for the test conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 50 marks. Marks of all experiments' write-ups are added and scaled down to 20 marks.

Semester End Examination(SEE)

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question carries 20 marks.
4. There will be two full questions (with a maximum of three sub questions) from each module
5. Each full question will have sub questions covering all the topics under a module.
6. The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)Text Books

1. **B.S.Grewal**:"Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

Reference Books

1. **V.Ramana**:"Higher Engineering Mathematics" McGraw-Hill Education,11th Ed.,2017
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5. **C.B Gupta, S. R Singh and Mukesh Kumar:** "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education (India)Pvt.Ltd 2015.
6. **H.K.Dass and Er.Rajnish Verma:** "Higher Engineering Mathematics" S.Chand Publication, 3rdEd., 2014.
7. **James Stewart:** "Calculus" Cengage Publications, 7thEd., 2019.
8. **David CLay:** "Linear Algebra and its Applications", Pearson Publishers, 4th Ed.,2018.
9. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6thEd., 2017.

Course Title:	Mathematics for Electrical and Electronics Engineering		
Course Code:	22MATE11	CIE Marks	50
Course Type(Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P:S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40hoursTheory+10-12Lab slots	Credits	04

Course objectives: The goal of this course (22MATE11)

- Familiarize the importance of series expansion and Vector calculus and Linear Algebra essential for electrical and electronics engineering.
- Analyze electrical and electronics engineering problems applying Partial derivatives and understand the value of limit (continuity) of function by using indeterminate forms.
- Develop the knowledge of polar curves to trace different types of curves.
- Applications of first order first degree differential equations.
- To develop the knowledge of matrices and linear algebra in a comprehensive manner.

Teaching-Learning Process

Pedagogy(General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework and quizzes, and documenting students' progress.
5. Five assignment problems on each module.
6. Encourage the students for group learning to improve their creative and analytical skills.
7. Show related short video lectures in the following ways:
    - As an introduction to new topics (pre-lecture activity).
    - As a revision of topics (post-lecture activity).
    - As additional examples (post-lecture activity).
    - As an additional material of challenging topics (pre-and post-lecture activity).
    - As a model solution of some exercises (post-lecture activity).

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1	Express the different types of functions in power series form.
CO2	Learn the notion of partial differentiation to compute rate of change multivariate functions and understand the concept of Indeterminate forms
CO3	Apply the knowledge of calculus to solve problems related to polar curves and graphical representation of different curves.
CO4	Solve first order linear/nonlinear differential equation analytically using standard methods and express the solution in graphical form.
CO5	Make use of matrix theory for solving for system of linear equations and compute Eigen values and Eigen vectors by using computational softwares.
CO6	Learn with modern mathematical tools namely SCILAB /PYTHON /MATLAB /

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√			
CO2	√	√	√			
CO3	√	√	√			
CO4	√	√	√			
CO5	√	√	√			

Course Articulation Matrix / Course mapping :

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

Note: 1-Low mapped, 2-Medium mapped, 3-High mapped

MODULE-1 SEQUENCE AND SERIES

Introduction of Sequence and series in EE & EC Engineering
Infinite series, tests for convergence/divergence, Limit comparison test, Ratio test, root test, Raabe's test, Alternating series, Absolute convergence and conditional convergence.

Self-study: Gauss's test, Cauchy integral test.

Applications: Sequence and Series expansion in communication signals.

(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE-2: INDETERMINATE FORMS AND PARTIAL DIFFERENTIATION

Introduction of Indeterminate forms and partial differentiation in EE & EC Engineering applications. Indeterminate forms - L'Hospital's rule. Problems.
Partial differentiation, total derivative - differentiation of composite functions. Jacobian and problems. Maxima and minima for a function of two variables. Problems.

Self-study: Euler's Theorem and problems. Method of Lagrange's undetermined multipliers with single constraint.

Applications: Applications of maxima and minima in EE & EC Engineering.

(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE-3 : DIFFERENTIAL CALCULUS

Introduction to polar coordinates and curvature relating to EE & EC Engineering applications.
Polar coordinates, Polar curves, angle between the radius vector and tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature - Cartesian, Parametric, Polar and Pedal forms. Problems only.

Self-study: Center and circle of curvature, evolutes, involutes and envelopes
Applications: Communication signals, manufacturing of microphones and Image processing.
(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE- 4: LINEAR AND NON-LINEAR ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER

Introduction to first order ordinary differential equations pertaining to the applications for EE & EC Engineering.
Exact and reducible to exact differential equations -Integrating factors type-1, linear and reducible to linear. Applications of ODE's – Orthogonal trajectories, Rate of Decay and growth, L-R and C-R circuits. Problems.

Self-Study: Applications of ODE's, Solvable for x , y, p and Clairaut's form.

Applications of ordinary differential equations: L-R and C-R circuits, Newton's law of cooling, Conduction of heat.
(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE- 5 :LINEAR ALGEBRA

Introduction of liner algebra related to EE & EC Engineering applications.
Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations - Gauss-Jordan method and approximate solution by Gauss-Seidel method. Eigen values and Eigen vectors, Rayleigh's power method to find the dominant Eigen value and Eigen vector. Problems

Self-Study: Solution of system of equations by Gauss-Jacobi iterative method, Gauss-elimination method. Inverse of a square matrix by Cayley- Hamilton theorem.
Applications of Linear Algebra: Network Analysis, Markov Analysis, Critical point of a network system. Optimum solution.
(RBT Levels: L1, L2 and L3) (8 Hours)

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1	Finding the sum of the series up to infinity
2	Finding the given series convergent and divergent
3	Evaluating the limits
4	Finding the Partial derivatives of a given function Finding partial derivatives, Jacobian and plotting the graph
5	Applications to Maxima and Minima of two variables
6	2D plots for Cartesian and polar curves Finding of intersection between two polar curves
7	Finding the angle between the radius vector and the tangent
8	Finding the pedal equation of the polar curves
9	Finding radius of curvature of a given curve

10	Solution of first order differential equation and plotting the graphs
11	Program to compute area, volume and centre of gravity
12	Solving the Linear differential equations
13	Evaluating the rank of matrix
14	Numerical solution of system linear equations , test for consistency .

Suggested software's : Mathematica/MatLab/Python/Scilab

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 45% of the maximum marks (22.5 marks out of 50). The minimum passing marks for the SEE is 35% of the maximum marks (18 marks out of 50).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

The CIE shall be conducted by the course teacher throughout the semester. The CIE marks for the theory component of the IC shall be 30 marks and for the laboratory component 20 Marks. The CIE marks for the theory component shall be 50 marks and scored will be reduced to 30.As below

- Three Tests each of 15 Marks; after the completion of the syllabus of 35-40%, 65-70%, and 90-100% respectively. Average of Best Two performances of the Internal Tests shall be considered for 15 Marks.
- Session wise assignments for 25 marks
- For Seminar and library work 05 marks
- Attendance 5 marks (95% to 100%), 04 marks (85% to 94%)

CIE for the practical component of the IC:

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The 35 marks are for conducting the experiment and preparation of the laboratory record, the other 15 marks shall be for the test conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 50 marks. Marks of all experiments' write-ups are added and scaled down to 20 marks.

Semester End Examination(SEE)

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question carries 20 marks.
4. There will be two full questions (with a maximum of three sub questions) from each module
5. Each full question will have sub questions covering all the topics under a module.
6. The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)Text Books

1. **B.S.Grewal**:"Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

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3. **N.P Bali and Manish Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications,10th Ed.,2022.
4. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw–Hill Book Co., New York, 6thEd., 2017.
5. **C.B Gupta, S. R Singh and Mukesh Kumar:** "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education (India)Pvt.Ltd 2015.
6. **H.K. Dass and Er. Rajnish Verma:** "Higher Engineering Mathematics" S.Chand Publication, 3rdEd., 2014.
7. **James Stewart:** "Calculus" Cengage Publications, 7thEd., 2019.
8. **David CLay:** "Linear Algebra and its Applications", Pearson Publishers, 4th Ed.,2018.
9. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6thEd., 2017.

Course Title:	Mathematics for Computer science & Engineering Stream		
Course Code:	22MATS11	CIE Marks	50
Course Type(Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P:S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40hoursTheory+10-12Lab slots	Credits	04

Course objectives: The goal of the course Advanced Calculus, Transforms and Numerical methods (22MATS11) is to

- Familiarize the importance of series expansion and Vector calculus essential for computer science engineering.
- Analyze computer science engineering problems applying Partial derivatives and understand the value of limit (continuity) of function by using indeterminate forms.
- Develop the knowledge of polar curves to trace different types of curves.
- Applications of first order first degree differential equations.
- To develop the knowledge of matrices and linear algebra in a comprehensive manner.

Teaching-Learning Process
Pedagogy(General Instructions):
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework and quizzes, and documenting students' progress.
5. Five assignment problems on each module.
6. Encourage the students for group learning to improve their creative and analytical skills.
7. Show short related video lectures in the following ways:
    - As an introduction to new topics (pre-lecture activity).
    - As a revision of topics (post-lecture activity).
    - As additional examples (post-lecture activity).
    - As an additional material of challenging topics (pre-and post-lecture activity).
    - As a model solution of some exercises (post-lecture activity).

Course outcome (Course Skill Set)
At the end of the course the student will be able to:

CO1	Express the different types of functions in power series form.
CO2	Learn the notion of partial differentiation to compute rate of change multivariate functions and understand the concept of Indeterminate forms
CO3	Apply the knowledge of calculus to solve problems related to polar curves and graphical representation of different curves.
CO4	Solve first order linear/nonlinear differential equation analytically using standard methods and express the solution in graphical form.
CO5	Make use of matrix theory for solving for system of linear equations and compute

CO6	Learn with modern mathematical tools namely SCILAB /PYTHON /MATLAB / MATHEMATICA

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√			
CO2	√	√	√			
CO3	√	√	√			
CO4	√	√	√			
CO5	√	√	√			

Course Articulation Matrix / Course mapping :

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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CO3	3	2	2		1				1			1			
CO4	3	2	2		1				1			1			
CO5	3	2	2		1				1			1			

Note: 1-Low mapped, 2-Medium mapped, 3-High mapped

MODULE-1 SEQUENCE AND SERIES

Introduction of Sequence and series in CS Engineering
Infinite series, tests for convergence/divergence, Limit comparison test, Ratio test, root test, Raabe's test, Alternating series, Absolute convergence and conditional convergence.

Self-study: Gauss's test, Cauchy integral test
Applications: Sequence and Series expansion in communication signals.

(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE-2: INDETERMINATE FORMS AND PARTIAL DIFFERENTIATION

Introduction of Indeterminate forms and partial differentiation in CS Engineering applications. Indeterminate forms - L'Hospital's rule. Problems.
Partial differentiation, total derivative - differentiation of composite functions. Jacobian and problems. Maxima and minima for a function of two variables. Problems.

Self-study: Euler's Theorem and problems. Method of Lagrange's undetermined multipliers with single constraint.

Applications: Applications of maxima and minima in computer science engineering.

(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE-3 : DIFFERENTIAL CALCULUS

Introduction to polar coordinates and curvature relating to CS Engineering applications.
Polar coordinates, Polar curves, angle between the radius vector and tangent, angle between two curves. Pedal equations. Curvature and Radius of curvature - Cartesian, Parametric, Polar and Pedal forms. Problems only.

Self-study: Center and circle of curvature, evolutes, involutes, and envelopes
Applications: Image processing.
(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE- 4: LINEAR AND NON-LINEAR ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER

Introduction to first order ordinary differential equations pertaining to the applications for CS Engineering.
Exact and reducible to exact differential equations -Integrating factors type-1, linear and reducible to linear. Applications of ODE's – Orthogonal trajectories, Rate of Decay and growth, L-R and C-R circuits. Problems.

Self-Study: Applications of ODE's, Solvable for x , y ,p and Clairaut's form.

Applications of ordinary differential equations: L-R and C-R circuits, Newton's law of cooling, Conduction of heat.
(RBT Levels: L1, L2 and L3) (8 Hours)

MODULE- 5 :LINEAR ALGEBRA

Introduction of liner algebra related to CS Engineering applications.
Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations - Gauss-Jordan method and approximate solution by Gauss-Seidel method. Eigen values and Eigen vectors, Rayleigh's power method to find the dominant Eigen value and Eigen vector. Problems

Self-Study: Solution of system of equations by Gauss-Jacobi iterative method, Gauss-elimination method. Inverse of a square matrix by Cayley- Hamilton theorem.
Applications of Linear Algebra: Network Analysis, Markov Analysis, Critical point of a network system. Optimum solution.
(RBT Levels: L1, L2 and L3) (8 Hours)

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
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11	Program to compute area, volume and centre of gravity
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Suggested software's : Mathematica/MatLab/Python/Scilab

Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation(CIE):

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The CIE marks for the theory component shall be 50 marks and scored will be reduced to 30.As below

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- Session wise assignments for 25 marks
- For Seminar and library work 05 marks
- Attendance 5 marks (95% to 100%), 04 marks (85% to 94%)

CIE for the practical component of the IC:

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Semester End Examination(SEE)

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2. The question paper will have ten full questions carrying equal marks.
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4. There will be two full questions (with a maximum of three sub questions) from each module
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Reference Books

1. **V. Ramana:**"Higher Engineering Mathematics" McGraw-Hill Education,11th Ed.,2017
2. **Srimanta Pal & Subodh C. Bhunia**: "Engineering Mathematics" Oxford University Press, 3rdEd., 2016.
3. **N.P Bali and Manish Goyal**: "A textbook of Engineering Mathematics" Laxmi Publications,10th Ed.,2022.
4. **C. Ray Wylie, Louis C. Barrett:** "Advanced Engineering Mathematics" McGraw–Hill Book Co., New York, 6thEd., 2017.
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8. **David CLay:** "Linear Algebra and its Applications", Pearson Publishers, 4th Ed.,2018.
9. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6thEd., 2017.

Course Title:	Mathematics for Civil Engineering Stream-II		
Course Code:	22MATC21	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/ Week	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40hoursTheory+10-12Lab slots	Credits	04

Course objectives : The goal of the course **Advanced Calculus, Transforms and Numerical methods (22MATC21)**is to

- **Familiarize** the importance of Integral calculus and Vector calculus essential for Civil engineering.
- **Analyze** Civil engineering problems applying Partial Differential Equations.
- **Develop** the knowledge of solving Civil engineering problems numerically.

Teaching-Learning Process
Pedagogy(General Instructions):
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework and quizzes, and documenting students' progress.
5. Five assignment problems on each module.
6. Encourage the students for group learning to improve their creative and analytical skills.
7. Show short related video lectures in the following ways:
    - As an introduction to new topics (pre-lecture activity).
    - As a revision of topics (post-lecture activity).
    - As additional examples (post-lecture activity).
    - As an additional material of challenging topics (pre-and post-lecture activity).
    - As a model solution of some exercises (post-lecture activity).

Course outcome (Course Skill Set)
At the end of the course the student will be able to:

CO1	Apply the knowledge of Integral calculus to solve Double and Triple Integral for evaluating surface area and volume related to Civil Engineering.
CO2	Illustrates the Applications of Multivariate calculus to understand the solenoidal and irrational vectors and also exhibit the inter dependence of line, surface and volume integrals.
CO3	Construct a variety of Partial Differential Equations for the problems in Civil engineering.
CO4	Apply the concept of numerical techniques to solve algebraic and non-algebraic equations for solving Civil engineering problems.
CO5	Demonstrate the various physical modules in Civil engineering through higher order differential equations.
CO6	Modern mathematical tools namely SCILAB /PYTHON /MATLAB / MATHEMATICA to solve problems in Civil engineering.

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√			
CO2	√	√	√			
CO3	√	√	√			
CO4	√	√	√			
CO5	√	√	√			

Course Articulation Matrix / Course mapping :

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

Note: 1-Low mapped, 2-Medium mapped, 3-High mapped

Module-1 : Definite Integrals and Improper Integrals.

Introduction to Integral Calculus in Civil Engineering applications.

Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find: Area and Volume by double integral. Problems.

Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions. Problems.

Self-Study: Volume by triple integration, Center of gravity.

Applications: Applications to mathematical quantities (Area, Surface area, Volume),. Analysis of probabilistic models.

(RBT Levels: L1, L2 and L3) (8 hours)

Module-2 :Vector Calculus

Introduction to Vector Calculus in Civil Engineering applications.

Vector Integration: Line integrals, Surface integrals. Applications to work done by a force and flux. Statement of Green's theorem, Stoke's theorem and Gauss divergence theorem and Problems.

Self-Study: Volume integral and Proof of Green's theorem, Stoke's theorem and Gauss divergence theorem.

Applications: Heat and mass transfer, oil refinery problems, environmental engineering. Analysis of stream lines.

(RBT Levels: L1, L2 and L3) (8 hours)

Module-3: Partial Differential Equations (PDE's)

Importance of partial differential equations for Civil Engineering application.
Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only. Solution of Lagrange's linear PDE. Derivation of one-dimensional heat equation and wave equation.
Self-Study: Solution of one-dimensional heat equation, wave equation by the method of separation of variables and Charpits method.
Applications: Design of structures (vibration of rod/membrane).
(RBT Levels: L1, L2 and L3) (8 hours)

Module-4 :Numerical methods

Importance of numerical methods for discrete data in the field of Civil Engineering.
Solution of algebraic and transcendental equations: Regula-Falsi and Newton-Raphson methods (only formulae). Problems.
Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula (All formulae without proof). Problems.
Numerical integration: Trapezoidal, Simpson's $(1/3)^{rd}$ and $(3/8)^{th}$ rules (without proof). Problems.

Self-Study: Bisection method, Lagrange's inverse Interpolation and Weddles rule.
Applications: Estimating the approximate roots, extreme values, Area, volume, surface area. Finding approximate solutions to Civil engineering problems.
(RBT Levels: L1, L2 and L3) (8 hours)

Module-5 : Ordinary Differential Equation

Introduction to Linear ordinary differential equations of second and Higher order for handling Civil Engineering applications.
Solution of second and higher order Ordinary Linear Differential Equations with constant coefficients, Inverse Differential Operator Method, Variation of Parameters method, applications of Differential equations LCR Circuits.

Self-Study: Singular Solutions and ODE with variable co-efficient.
Applications: Application of second order ODE, initial conditions and initial value problems.
(RBT Levels: L1, L2 and L3) (8 hours)

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1	Evaluation of Double and triple integrals.
2	Evaluation of Beta and Gamma functions.
3	Finding surface integrals
4	Evaluation of surface area by Green's theorem.
5	Formation of PDE w.r.t. one independent variable.
6	Solution of PDE by direct integration.
7	Newton's forward and Backward interpolation formula.
8	Solution of numerical integration by Simpson's $(1/3)^{rd}$ rule.
9	Finding the roots for second order ODE.
10	Finding the roots by the method of variation of parameter.

Suggested software's : Mathematica /MatLab/Python/Scilab

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 45% of the maximum marks (22.5 marks out of 50). The minimum passing marks for the SEE is 35% of the maximum marks (18 marks out of 50).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

The CIE shall be conducted by the course teacher throughout the semester. The CIE marks for the theory component of the IC shall be 30 marks and for the laboratory component 20 Marks.

The CIE marks for the theory component shall be 50 marks and scored will be reduced to 30.As below

- Three Tests each of 15 Marks; after the completion of the syllabus of 35-40%, 65-70%, and 90-100% respectively. Average of Best Two performances of the Internal Tests shall be considered for 15 Marks.
- Session wise assignments for 25 marks
- For Seminar and library work 05 marks
- Attendance 5 marks (95% to 100%), 04 marks (85% to 94%)

CIE for the practical component of the IC:

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The 35 marks are for conducting the experiment and preparation of the laboratory record, the other 15 marks shall be for the test conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 50 marks. Marks of all experiments' write-ups are added and scaled down to 20 marks.

Semester End Examination(SEE)

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question carries 20 marks.
4. There will be two full questions (with a maximum of three sub questions) from each module
5. Each full question will have sub questions covering all the topics under a module.
6. The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)Text Books

1. **B.S.Grewal**:"Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

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8. **David CLay:** "Linear Algebra and its Applications", Pearson Publishers, 4th Ed.,2018.
9. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6thEd., 2017.

Course Title:	Mathematics for Mechanical Engineering Stream-II		
Course Code:	22MATM21	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/ Week	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40hoursTheory+10-12Lab slots	Credits	04

Course objectives : The goal of the course **Advanced Calculus, Transforms and Numerical methods (22MATM21)**is to

- **Familiarize** the importance of Integral calculus and Vector calculus essential for mechanical engineering.
- **Analyze** mechanical engineering problems applying Partial Differential Equations.
- **Develop** the knowledge of solving mechanical engineering problems numerically.

Teaching-Learning Process
Pedagogy(General Instructions):
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework and quizzes, and documenting students' progress.
5. Five assignment problems on each module.
6. Encourage the students for group learning to improve their creative and analytical skills.
7. Show short related video lectures in the following ways:
    - As an introduction to new topics (pre-lecture activity).
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    - As additional examples (post-lecture activity).
    - As an additional material of challenging topics (pre-and post-lecture activity).
    - As a model solution of some exercises (post-lecture activity).

Course outcome (Course Skill Set)
At the end of the course the student will be able to:

CO1	Apply the knowledge of Integral calculus to solve Double and Triple Integral for evaluating surface area and volume related to Mechanical Engineering.
CO2	Illustrates the Applications of Multivariate calculus to understand the solenoidal and irrational vectors and also exhibit the inter dependence of line, surface and volume integrals.
CO3	Construct a variety of Partial Differential Equations for the problems in mechanical engineering.
CO4	Apply the concept of numerical techniques to solve algebraic and non-algebraic equations for solving mechanical engineering problems.
CO5	Demonstrate the various physical modules in mechanical engineering through higher order differential equations.
CO6	Modern mathematical tools namely SCILAB /PYTHON /MATLAB / MATHEMATICA to solve problems in mechanical engineering.

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√			
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CO4	√	√	√			
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Course Articulation Matrix / Course mapping :

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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Note: 1-Low mapped, 2-Medium mapped, 3-High mapped

Module-1 : Definite Integrals and Improper Integrals.

Introduction to Integral Calculus in Mechanical Engineering applications.

Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find: Area and Volume by double integral. Problems.

Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions. Problems.

Self-Study: Volume by triple integration, Center of gravity.

Applications: Applications to mathematical quantities (Area, Surface area, Volume),. Analysis of probabilistic models.

(RBT Levels: L1, L2 and L3) (8 hours)

Module-2 :Vector Calculus

Introduction to Vector Calculus in Mechanical Engineering applications.

Vector Integration: Line integrals, Surface integrals. Applications to work done by a force and flux. Statement of Green's theorem, Stoke's theorem and Gauss divergence theorem and Problems.

Self-Study: Volume integral and Proof of Green's theorem, Stoke's theorem and Gauss divergence theorem.

Applications: Heat and mass transfer, oil refinery problems, environmental engineering. Analysis of stream lines.

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Module-3: Partial Differential Equations (PDE's)

Importance of partial differential equations for Mechanical Engineering application.
Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only. Solution of Lagrange's linear PDE. Derivation of one-dimensional heat equation and wave equation.
Self-Study: Solution of one-dimensional heat equation, wave equation by the method of separation of variables and Charpits method.
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Self-Study: Bisection method, Lagrange's inverse Interpolation and Weddles rule.
Applications: Estimating the approximate roots, extreme values, Area, volume, surface area. Finding approximate solutions to Mechanical engineering problems.
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Module-5 : Ordinary Differential Equation

Introduction to Linear ordinary differential equations of second and Higher order for handling Mechanical Engineering applications.
Solution of second and higher order Ordinary Linear Differential Equations with constant coefficients, Inverse Differential Operator Method, Variation of Parameters method, applications of Differential equations LCR Circuits.

Self-Study: Singular Solutions and ODE with variable co-efficient.
Applications: Application of second order ODE, initial conditions and initial value problems.
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Suggested software's : Mathematica /MatLab/Python/Scilab

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- Attendance 5 marks (95% to 100%), 04 marks (85% to 94%)

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3. Each full question carries 20 marks.
4. There will be two full questions (with a maximum of three sub questions) from each module
5. Each full question will have sub questions covering all the topics under a module.
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9. **Gareth Williams:** "Linear Algebra with applications", Jones Bartlett Publishers Inc., 6thEd., 2017.

CourseTitle:	Mathematics for Electronics and Communication Engineering Stream-II		
CourseCode:	22MATE21	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hoursTheory+10-12Lab slots	Credits	04

Course objectives : The goal of the course **Advanced Calculus, Transforms and Numerical methods (22MATE21)**is to

- **Familiarize** the importance of Integral calculus and Vector calculus essential for electronics and electrical engineering.
- **Analyze** electronics and electrical engineering problems applying Partial Differential Equations.
- **Develop** the knowledge of solving electronics and electrical engineering problems numerically.

Teaching-Learning Process

Pedagogy(General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework and quizzes, and documenting students' progress.
5. Five assignment problems on each module.
6. Encourage the students for group learning to improve their creative and analytical skills.
7. Show short related video lectures in the following ways:
    - As an introduction to new topics (pre-lecture activity).
    - As a revision of topics (post-lecture activity).
    - As additional examples (post-lecture activity).
    - As an additional material of challenging topics (pre-and post-lecture activity).
    - As a model solution of some exercises (post-lecture activity).

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

CO1	Apply the knowledge of Integral calculus to solve Double and Triple integral for evaluating surface area and volume related to EC and EE Engineering.
CO2	Apply the knowledge of Linear Algebra to find the linear space, basis, dimensions and linearly independent, linearly dependent of vector space
CO3	Apply the concept of numerical techniques to solve algebraic and non-algebraic equations for EC and EE engineering problems, Studying the Forward and Backward Finite differences and solve the problems on Interpolation.
CO4	Apply the knowledge of Laplace transform from time domain to frequency domain (Signal and image processing) which transforms differential equation into algebraic equation (Partial fractions).
CO5	Demonstrate the various physical modules through higher differential equations and solve such linear ordinary differential equations related to the EC and EE

	Engineering.
CO6	Familiarize with modern mathematical tools namely SCILAB /PYTHON /MATLAB / MATHEMATICA

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√			
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CO3	√	√	√			
CO4	√	√	√			
CO5	√	√	√			

Course Articulation Matrix / Course mapping :

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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Note: 1-Low mapped, 2-Medium mapped, 3-High mapped

Module-1 : Definite Integrals and Improper Integrals.

Introduction to Integral Calculus EC and EE Engineering applications.

Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find: Area and Volume by double integral. Problems.

Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions. Problems.

Self-Study: Volume by triple integration, Center of gravity.

Applications: Applications to mathematical quantities (Area, Surface area, Volume),. Analysis of probabilistic models.

(RBT Levels: L1, L2 and L3) (8 hours)

Module-2 :Vector Calculus

Importance of Vector Space and Linear Transformations in the field of EC and EE engineering applications.

Vector spaces: Definition and examples, subspace, linear span, Linearly independent and dependent sets, Basis and dimension.

Linear transformations: Definition and examples, Algebra of transformations, Matrix of a linear transformation. Change of coordinates, Rank and nullity of a linear operator, Rank-Nullity theorem. Inner product spaces and orthogonality.

Self-study: Angles and Projections. Rotation, reflection, contraction and expansion.

Applications: Image processing, AI & ML, Graphs and networks, computer graphics, Antenna.

(RBT Levels: L1, L2 and L3) (8 hours)

Module-3: Numerical Methods-I

Importance of numerical methods for discrete data in the field of EC and EE engineering applications.

Solution of polynomial and transcendental equations: Regula-Falsi method and Newton-Raphson method (only formulae). Problems.

Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula (All formulae without proof). Problems.

Self Study: Bisection Method, Secant method, Numerical differentiation and Inverse Lagrange's method.

Applications: Power Systems

(RBT Levels: L1, L2 and L3) (8 hours)

Module-4 : Laplace Transforms

Introduction to Laplace Transforms in EC and EE Engineering.

Laplace Transforms: Definition, Laplace transforms of Elementary functions, properties(without proof) periodic function, Unit step function, Unit impulse function.

Inverse Laplace Transforms: Definition, Convolution Theorem (without proof) and Finding Inverse Laplace transform by convolution Theorem. Solution of Linear Differential equations using Laplace Transforms and Applications.

Self-Study: Laplace transform of ODE.

Applications: Network analysis, Signal Processing, and Image Processing.

(RBT Levels: L1, L2 and L3) (8 hours)

Module-5 :Ordinary Differential Equation

Introduction to Linear ordinary differential equations of second and higher order for handling EC and EE Engineering applications.

Solution of second and higher order Ordinary Linear Differential Equations with constant coefficients, Inverse Differential Operator Method, Variation of Parameters method, applications of Differential equations LCR Circuits.

Self-Study: Singular Solutions.

Applications: Application of second order ODE, initial conditions and initial value problems.

(RBT Levels: L1, L2 and L3) (8 hours)

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1	Evaluation of Double and triple integrals.
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Suggested software's : Mathematica/MatLab/Python/Scilab

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A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

The CIE shall be conducted by the course teacher throughout the semester. The CIE marks for the theory component of the IC shall be 30 marks and for the laboratory component 20 Marks.

The CIE marks for the theory component shall be 50 marks and scored will be reduced to 30.As below

- Three Tests each of 15 Marks; after the completion of the syllabus of 35-40%, 65-70%, and 90-100% respectively. Average of Best Two performances of the Internal Tests shall be considered for 15 Marks.
- Session wise assignments for 25 marks
- For Seminar and library work 05 marks
- Attendance 5 marks (95% to 100%), 04 marks (85% to 94%)

CIE for the practical component of the IC:

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The 35 marks are for conducting the experiment and preparation of the laboratory record, the other 15 marks shall be for the test conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 50 marks. Marks of all experiments' write-ups are added and scaled down to 20 marks.

Semester End Examination(SEE)

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question carries 20 marks.
4. There will be two full questions (with a maximum of three sub questions) from each module
5. Each full question will have sub questions covering all the topics under a module.
6. The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:

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Course Title:	Mathematics for Computer Science and Engineering Stream-II		
Course Code:	22MATS21	CIE Marks	50
Course Type (Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P:S)	2:2:2:0	Exam Hours	03+02
Total Hours of Pedagogy	40 hoursTheory+10-12Lab slots	Credits	04

Course objectives : The goal of the course **Advanced Calculus, Transforms and Numerical methods (22MATS21)**is to

- **Familiarize** the importance of Integral calculus and Vector calculus essential for Computer science and engineering.
- **Analyze** electronics and electrical engineering problems applying Partial Differential Equations.
- **Develop** the knowledge of solving Computer science and engineering problems numerically.

Teaching-Learning Process
Pedagogy(General Instructions):
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop student's theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework and quizzes, and documenting students' progress.
5. Five assignment problems on each module.
6. Encourage the students for group learning to improve their creative and analytical skills.
7. Show short related video lectures in the following ways:
    - As an introduction to new topics (pre-lecture activity).
    - As a revision of topics (post-lecture activity).
    - As additional examples (post-lecture activity).
    - As an additional material of challenging topics (pre-and post-lecture activity).
    - As a model solution of some exercises (post-lecture activity).

Course outcome (Course Skill Set)
At the end of the course the student will be able to:

CO1	Apply the knowledge of Integral calculus to solve Double and Triple integral for evaluating surface area and volume related to Computer Science and Engineering.
CO2	Apply the knowledge of Linear Algebra to find the linear space, basis, dimensions and linearly independent, linearly dependent of vector space
CO3	Apply the concept of numerical techniques to solve algebraic and non-algebraic equations for Computer Science and engineering problems, Studying the Forward and Backward Finite differences and solve the problems on Interpolation.
CO4	Apply the knowledge of Laplace transform from time domain to frequency domain (Signal and image processing) which transforms differential equation into algebraic equation (Partial fractions).

CO5	Demonstrate the various physical modules through higher differential equations and solve such linear ordinary differential equations related to the Computer Science andEngineering.
CO6	Familiarize with modern mathematical tools namely SCILAB /PYTHON /MATLAB / MATHEMATICA

Bloom's level of the course outcomes:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√			
CO2	√	√	√			
CO3	√	√	√			
CO4	√	√	√			
CO5	√	√	√			

Course Articulation Matrix / Course mapping :

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

Note: 1-Low mapped, 2-Medium mapped, 3-High mapped

Module-1 : Definite Integral and Improper Integral.

Introduction to Integral Calculus in Computer Science Engineering applications.

Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates. Applications to find: Area by double integral. Problems.

Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions. Problems.

Self-Study: Volume by triple integration, Center of gravity.

Applications: Applications to mathematical quantities (Area, Surface area, Volume),. Analysis of probabilistic models.

(RBT Levels: L1, L2 and L3)

(8 hours)

Module-2 : Advanced Linear Algebra

Importance of Vector Space and Linear Transformations in the field of Computer science and engineering applications.

Vector spaces: Definition and examples, subspace, linear span, Linearly independent and dependent sets, Basis and dimension.

Linear transformations: Definition and examples, Algebra of transformations, Matrix of a linear transformation.

Self-study: Change of coordinates, Rank and nullity of a linear operator, Rank-Nullity theorem. Inner product spaces and orthogonality. Angles and Projections. Rotation, reflection, contraction and expansion.

Applications: Image processing, AI & ML, Graphs and networks, computer graphics.

(RBT Levels: L1, L2 and L3) (8 hours)

Module - 3: Numerical Methods

Importance of numerical methods for discrete data in the field of Computer science and engineering applications.

Solution of polynomial and transcendental equations: Regula-Falsi method and Newton-Raphson method (only formulae). Problems.

Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula (All formulae without proof). Problems.

Self Study: Bisection Method, Secant method, Numerical differentiation and Inverse Lagrange's method.

Applications: Power Systems

(RBT Levels: L1, L2 and L3) (8 hours)

Module - 4 : Laplace Transforms

Introduction to Laplace Transforms in Computer Science & Engineering.

Laplace Transforms: Definition, Laplace transforms of Elementary functions, properties (without proof) periodic function, Unit step function, Unit impulse function.

Inverse Laplace Transforms: Definition, Illustrative examples on Laplace transform, Convolution Theorem (without proof) and Finding Inverse Laplace transform by convolution Theorem. Solution of Linear Differential equations using Laplace Transforms and Applications (5 Assignment Problem).

Self-Study: Solution of first order simultaneous differential equation and Laplace transform of derivative.

Applications: Network analysis, Signal Processing, and Image Processing.

(RBT Levels: L1, L2 and L3) (8 hours)

Module-5 : Ordinary Differential Equation-2

Introduction to Linear ordinary differential equations of second and Higher order for handling Computer Science and Engineering applications.

Solution of second and higher order Ordinary Linear Differential Equations with constant coefficients, Inverse Differential Operator Method (Types -I, II and III only), Variation of Parameters method, applications of Differential equations LCR Circuits.

Self-Study: Singular Solutions and Inverse Differential Operator Method (Types -IV and V).

Applications: Application of second order ODE, initial conditions and initial value problems.

(RBT Levels: L1, L2 and L3) (8 hours)

List of Laboratory experiments (2 hours/week per batch/ batch strength 15)
10 lab sessions + 1 repetition class + 1 Lab Assessment

1	Evaluation of Double and triple integrals.
2	Evaluation of Beta and Gamma functions.
3	Finding surface integrals
4	Evaluation of surface area by Green's theorem.
5	Formation of PDE w.r.t. one independent variable.
6	Solution of PDE by direct integration.
7	Newton's forward and Backward interpolation formula.
8	Solution of numerical integration by Simpson's $(1/3)^{rd}$ rule.
9	Finding the roots for second order ODE.

10	Finding the roots by the method of variation of parameter.

Suggested software's : Mathematica/MatLab/Python/Scilab

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing marks for the CIE is 45% of the maximum marks (22.5 marks out of 50). The minimum passing marks for the SEE is 35% of the maximum marks (18 marks out of 50).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

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