24MA101
Mathematics – I
(Linear Algebra, Series and Calculus)

Course Category:	**Basic Sciences**	**Credits:**	**4**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3-0-2**
Pre-requisites:	**10+2 Mathematics**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description: An overview of the fundamental concepts of linear algebra, infinite series, Differential calculus, multiple integrals and vector calculus, with a focus on the applications in solving engineering problems.

Course Objectives:

- Introduce techniques for solving systems of linear equations, determining Eigen values and eigenvectors, and performing matrix diagonalization.
- Explain methods to analyze the convergence and divergence of an infinite series and to expand functions using Taylor's or Maclaurin's series
- Familiarize differentiation rules and theorems to solve problems related to rates of change and optimization
- Explain the concept of double and triple integrals to calculate areas and volumes for two-dimensional and three-dimensional objects
- Teach operations on vector-valued functions, including line and surface integrals, as well as the concepts of curl and divergence, and their applications in engineering

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes	BTL
CO1	Solve the systems of equations and analyze engineering problems using linear algebra techniques	K3
CO2	Apply the convergence tests of an infinite series to solve engineering problems	K3
CO3	Use differential calculus to solve optimization problems and analyze rates of change in engineering applications	K3
CO4	Calculate areas and volumes using double and triple integrals.	K3
CO5	Apply vector calculus concepts to solve problems involving work done by force fields and analyze related physical phenomena	K3

Course articulation matrix

	POs											PSOs	
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**2**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**2**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**2**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO4	**2**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	**2**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

(1-Low, 2 -Medium, 3–High)

Course Content

Unit-I

Linear Algebra **[T2]**

Rank of a matrix (Echelon form), Finding the inverse by Gauss-Jordan method, System of linear equations: Homogeneous and Non-Homogeneous, Linear transformations, Orthogonal transformation, Eigen values and Eigenvectors, Reduction to Diagonal form

Unit-II

Infinite Series **[T2]**

Infinite Sequence (Definition), Infinite Series, Comparison Tests, Integral Test, Ratio and Root Test, Alternating Series, Absolute and Conditional convergence.

Unit-III

Differential Calculus **[T2]**

Mean value theorems: Rolle's theorem (without proof), Lagrange's mean value theorem (without proof), Taylor's and Maclaurin's theorems with Lagrange's form of remainder (without proof), Expansions of functions: Taylor's and Maclaurin's series Functions of Several Variables: Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers

Unit-IV

Multiple Integral **[T2]**

Double integrals (Cartesian coordinates), Change of order of integration, Triple integrals, Change of variables to polar, cylindrical and spherical coordinates, Areas as double integration and Volumes as triple integration

Unit-V

Vector Calculus **[T2]**

Introduction to Gradient of a scalar field, Divergence and Curl of a vector field, Line integral, Green's theorem in the plane (without proof), Surface integrals, Stoke's theorem (without proof) and Gauss divergence theorem (without proof)

Text Books:

1. Weir Maurice D., Hass Joel & Giodano Frank R. (2013). *Thomas' Calculus*. (11th Edition). Pearson Education,inc..
2. Grewal B. S. (2017). *Higher Engineering Mathematics*. (44th Edition). Khanna Publishers.

Reference Books:

1. Kreyszig Erwin. (2013). *Advanced Engineering Mathematics*.(9th Edition).Wiley Publishers.
2. Ramana B.V.(2007). *Higher Engineering Mathematics*.Tata Mc.Graw Hill

Web Resources:

MIT OpenCourseWare: Linear Algebra
https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/
NPTEL: Linear Algebra
https://archive.nptel.ac.in/courses/111/104/111104137/
MIT OpenCourseWare: Multivariable Calculus
https://ocw.mit.edu/courses/18-02sc-multivariable-calculus-fall-2010/
NPTEL: Engineering Mathematics-I
https://archive.nptel.ac.in/courses/111/105/111105121/

24MA101
LINEAR ALGEBRA, SERIES AND CALCULUS

Course Category:	**HS**	**Credits:**	**1C**
Course Type:	**Integrated Lab**	**Lecture-Tutorial-Practice:**	**0L-0T-2P**
Pre-requisites:	**Mathematics-I**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

An overview of the functions of MathWorks Symbolic Math Tool Box to solve problems in Matrix algebra, differential calculus, multiple integrals, vector calculus and to test the nature of series.

Course Objectives:

1. Find inverse, rank, eigen values, eigen vectors of a matrix and solution of system of linear equations.
2. Analyze the convergence and divergence of infinite series.
3. Find ordinary and partial derivatives
4. Expand functions as Taylor's and Maclaurin's series.
5. Determine extreme values of multi-variable function with and without constraints.
6. Calculate areas and volumes using double and triple integrals.
7. Find gradient, divergent and curl.

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes:	BTL
CO1	Find rank, eigen values, eigen vectors of a matrix, solution of system of linear equations.	(K3)
CO2	Examine the convergence/divergence of infinite series	(K3)
CO3	Determine derivatives, series expansion and extreme values of a function	(K3)
CO4	Calculate areas and volumes using double and triple integrals	(K3)
CO5	Find gradient of scalar field, divergence and curl of vector field	(K3)

Course articulation matrix

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2-- Medium, 3 -- High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2			1						
CO2	2	2			1						
CO3	2	2			1						
CO4	2	2			1						
CO5	2	2			1						

Course Content

Unit-I

`inv()` function to find inverse of a matrix
`rank()` function to find rank of a matrix
`rref()` function to solve system of linear equations
`eig()` function to find eigen values and eigen vectors of a matrix

Unit-II

`vpa()` function to evaluate numerically each term of series
`symsum()` function to test the nature of the series

Unit-III

`diff()` function to find ordinary and partial derivatives
`taylor()` function to expand functions as Taylor's and Maclaurin's series
`fmincon()` function to find minimum of a function with constraints

Unit-IV

`int()` function to find double and triple integrals

Unit-V

`gradient()` function to find gradient of a scalar point function
`divergence()` function to find divergence of a vector point function
`curl()` function to find curl of a vector point function

Text Books:

Matlab Lab Manual

Web Resources:

- MathWorks Linear Algebra Documentation
  Linear Algebra - MATLAB & Simulink - MathWorks India
- MathWork Symbolic Calculus Tool Box
  Calculus - MATLAB & Simulink - MathWorks India
- MathWork Symbolic Math Tool Box
  Symbolic Math Toolbox Documentation - MathWorks India
- MathWork Optimization Tool Box
  Optimization Toolbox Documentation - MathWorks India
- MathWork Symbolic Calculus Tool Box
  Calculus - MATLAB & Simulink - MathWorks India

24CY102
Engineering Chemistry

Course Category:	**Basic Sciences**	**Credits:**	**3**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3-0-0**
Pre-requisites:	**10+2 Chemistry**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

The course is designed for B.Tech. Electrical, Electronics and Communications and Instrumentation Engineering students, providing essential and applied knowledge of Chemistry relevant to their fields. Understanding the specific application of materials based on their characteristic properties, which are determined by their structural and bonding aspects, is crucial for appropriate utilization. With this focus, the course covers the working of electrodes, sensors, batteries, fuel cells and super capacitors which are application of principles of electrochemistry. Also, the course enlightens the students on mechanistic aspects of corrosion and its control, chemical aspects of materials useful in electrical and electronics engineering. Further, it focuses on the principles and instrumentation of various instrumental techniques.

Course Objectives:

1. Impart knowledge on the functioning of electrodes, potentiometric and conductometric sensors.
2. Discuss construction and working of different types of batteries, fuel cells and super capacitors based on the principles of electrochemistry.
3. Analyse various corrosion processes and propose control methods depending on the principles of corrosion.
4. Explore the chemical aspects of various materials used in electrical, electronics and communications engineering.
5. Explain the principles, instrumentation of different instrumental techniques and their applications

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes	BTL
CO1	Apply the principles of electrochemistry to analyse working of electrodes and sensors	**K3**
CO2	Analyse various electrochemical energy systems for their application in engineering	**K4**
CO3	Assess the challenges arising due to corrosion of electronic devices	**K5**
CO4	Demonstrate the knowledge of materials for their use in manufacture of electrical and electronic devices	**K3**
CO5	Compare different analytical techniques and their instrumentation for their application in qualitative and quantitative analysis	**K4**

Course articulation matrix

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	1	2	-	-	-	-	-	-	-	-
CO2	3	-	2	-	1	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-
CO4	3	-	2	-	1	-	-	-	-	-	-
CO5	3	2	-	1	-	-	-	-	-	-	-

(1-Low, 2 -Medium, 3–High) (WK1)

Course Content

Unit-I
Electrochemistry

- Electrodes, electrode potentials and electrochemical cells
- The Nernst equation with numerical problems for calculating electrode potential and emf
- Reference electrodes – Calomel and Ag/AgCl electrodes, Ion-selective electrodes, glass electrode - construction, working, advantages, and disadvantages
- Potentiometry – redox titrations
- Conductometry (acid-base reactions)
- Electrochemical sensors – principle and applications

Unit-II
Electrochemical Energy Systems

- Types of electrochemical energy systems – charging vs. discharging
- Primary vs. secondary batteries
- Lithium-ion batteries – Lithium iron phosphate and lithium cobalt oxide – construction and working of the batteries including cell reactions
- Fuel cells – hydrogen-oxygen fuel cell and polymer electrolyte membrane fuel cell
- Super capacitors – principle, classification and applications
- Chemistry of fast charging EVs

Unit-III
Corrosion and Its Control

- Introduction to corrosion, causes and examples
- Electrochemical corrosion: hydrogen evolution and oxygen absorption corrosion

- Differential aeration corrosion
- Galvanic corrosion and its control, including the galvanic series
- Corrosion in microelectronic devices
- Factors influencing corrosion
- Electroplating and electroless plating

Unit-IV
Chemistry of Electrical and Electronic Materials

- Conducting polymers: Types of conducting polymers, mechanisms of conduction in undoped, doped polyacetylene and engineering applications of conducting polymers.
- Other materials of conduction: Production of electronic grade silicon from quartz and its applications, metal compounds as semiconductors, applications of carbon nanotubes and graphene in electrical and electronic industry.

Unit-V
Analytical Instrumentation Techniques

- Electromagnetic spectrum, Interaction of radiation with matter.
- UV-Visible spectroscopy: principle, electronic transitions, various shifts in UV-Visible spectroscopy, Lambert-Beer's law, Instrumentation, qualitative and quantitative applications of UV-Visible spectroscopy.
- Infrared spectroscopy: principle, types of vibrations, selection rule for vibrations in diatomic molecules, Instrumentation, qualitative and quantitative applications of IR spectroscopy.

Text Books:

1. Ramesh, S. (2013). *Engineering chemistry* (2nd ed.). Wiley India.
2. ShikhaAgarwal, (2015). *Engineering chemistry: fundamentals and applications*(1st ed.). Cambridge University Press.
3. Jain, P.C.(2018).*Engineering chemistry* (17th ed.). DhanpatRai.

Reference Books:

1. PrasanthaRath, &ArunaKumari, S. (2023).*Engineering chemistry* (1st ed.). Cengage.
2. ArunBahl, Bahl, B. S., &Tuli, G. D. (2020). *Essentials of physical chemistry* (28th ed.). S. Chand.
3. Haghi, A. K., Mercader, A. G., Balkoese, D., &Mukbaniani, O. V. (2021).*Applied chemistry and chemical engineering*, (1st ed.). CRC Press, Taylor & Francis Group.

4. Skoog, D. A., West, D. M., Holler, F. J.,&Crouch, S. R. (2022).*Fundamentals of analytical chemistry* (10th ed.). Cengage.
5. Fontana, M. G. (2017). *Corrosion engineering* (3rd ed.). McGraw-Hill Education.
6. Swaminathan, P. (2017). *Semiconductor materials, devices, and fabrication*. Wiley.
7. Banwell, C. N., &McCash, E. M. (2017). *Fundamentals of molecular spectroscopy* (4th ed.). McGraw-Hill Education.

Web Resources:

- https://www.sciencedirect.com/topics/chemistry/electrochemistry
- https://wme-z1.pwr.edu.pl/wp-content/uploads/2017/05/Basics-of-Electrochemistry.pdf
- https://ocw.mit.edu/courses/10-626-electrochemical-energy-systems-spring-2014/pages/lecture-notes/
- https://pressbooks.online.ucf.edu/chemistryfundamentals/chapter/batteries-and-fuel-cells-2/
- https://pesjournal.net/journal/v3-n1/2.pdf
- https://www.researchgate.net/publication/275028997_Corrosion_and_Corrosion_Control
- https://pubs.rsc.org/en/content/articlehtml/2021/ra/d0ra07800j
- https://nanografi.com/blog/application-areas-of-nanotechnology-in-display-and-communication-technology/
- https://personal.utdallas.edu/~goeckner/plasma_tech_class/AgilentSpectroPub4.pdf
- https://personal.utdallas.edu/~scortes/ochem/OChem_Lab1/recit_notes/ir_presentation.pdf

24CY103
Chemistry for Engineers

Course Category:	**Basic Sciences**	**Credits:**	**3**
Course Type:	**Theory**	**Lecture-Tutorial- Practice:**	**3-0-0**
Pre-requisites:	**10+2 Chemistry**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

The course is designed for Civil and Mechanical Engineering first year students, providing essential and applied knowledge of Chemistry relevant to their fields. Understanding the specific application of materials based on their characteristic properties, which are determined by their structural and bonding aspects, is crucial for appropriate utilization. With this focus, the course covers the working principles of electrodes, sensors, batteries, and fuel cells, applying principles of electrochemistry. Additionally, it delves into the mechanistic aspects of lubricants and the composition of cement, concrete, composites, refractories, glasses, and alloy steels. Furthermore, the course emphasizes the principles and control methods of corrosion in various metal structures.

Course Objectives:

1. Impart knowledge on the functioning of electrodes, batteries and fuel cells, grounded in electrochemical principles.
2. Analyse various corrosion processes and propose control methods based on corrosion principles.
3. Discuss structural and compositional aspects of engineering materials such as polymers, glasses, and alloy steels.
4. Explore the composition, nature, properties, and applications of different types of cements, concrete, and refractories.
5. Explain the mechanisms and properties of lubricants, and the composition of composite materials, highlighting their engineering applications.

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes	BTL
CO1	Apply the knowledge of basic electrochemistry principles to electrodes, batteries and fuel cells	**K3**
CO2	Analyse various corrosion processes and control methods	**K4**
CO3	Analyse the dependence of applications of polymers, glasses and alloy steels on their composition, bonding and structures	**K4**
CO4	Correlate the characteristic features of cements, concrete and refractories with chemical composition and chemical reactions involved	**K4**

CO5	Apply the chemical aspects of lubricants and composite materials to assess their engineering applications	**K3**

Course articulation matrix

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	1	2	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-
CO3	3	-	2	1	-	-	-	-	-	-	-
CO4	3	-	2	1	-	-	-	-	-	-	-
CO5	3	-	2	1	-	-	-	-	-	-	-

(1-Low, 2 -Medium, 3–High) (WK1)

Course Content

Unit-I
Electrochemistry

- Electrodes, electrode potentials and electrochemical cells
- The Nernst equation with numerical problems for calculating electrode potential and emf
- Reference electrodes – Calomel and Ag/AgCl electrodes, Ion-selective electrodes, glass electrode - construction, working, advantages, and disadvantages
- Conductometric analysis (acid-base reactions)
- Batteries, with a focus on lithium-ion ($LiCoO_2$)battery
- Fuel cells, specifically the hydrogen-oxygen fuel cell

Unit-II
Corrosion and its control

- Introduction to corrosion and its causes
- Electrochemical corrosion: hydrogen evolution and oxygen absorption corrosion
- Differential aeration corrosion
- Scaling and corrosion in boilers and their control
- Galvanic corrosion and its control, including the galvanic series
- Surface coatings: types of metallic coatings
- Hot dipping processes: galvanizing and tinning

Unit-III
Polymer Chemistry, Glasses and Alloy Steels

- Polymer chemistry: Introduction, types of polymerization, thermoplastics and thermosetting plastics, preparation, properties and applications of PVC, Nylon-6,6, Urea-formaldehyde and Polyurethane.
- Glasses: Composition, types of glasses, properties and engineering applications.
- Alloy Steels: Types of steels, specific effects of alloying elements, industrial applications of alloy steels.

Unit-IV
Chemistry of Cement and Refractories

- Cement: Composition, manufacture of Portland cement, setting and hardening of cement and chemical reactions involved, concrete and RCC, reactions involved in corrosion of reinforcement steel, degradation and protection of concrete.
- Refractories: Classification and properties – refractoriness, RUL test, porosity, and applications of refractories.

Unit-V
Lubricants and Composite Materials

- Lubricants: Friction and effects of frictional heat, lubricants, mechanisms of lubrication, types of lubricants based on physical state, properties of lubricants – viscosity, flash and fire points, mechanical stability.
- Composite materials: Constituents of composites, types of composites and engineering applications of composites.

Text Books:

1. Ramesh, S. (2013). *Engineering chemistry* (2nd ed.). Wiley India.
2. ShikhaAgarwal, (2015). *Engineering chemistry: fundamentals and applications*(1st ed.). Cambridge University Press.
3. Jain, P.C.(2018).*Engineering chemistry* (17th ed.). DhanpatRai.

Reference Books:

1. PrasanthaRath, &ArunaKumari, S. (2023).*Engineering chemistry* (1st ed.). Cengage.
2. ArunBahl, Bahl, B. S., &Tuli, G. D. (2020). *Essentials of physical chemistry* (28th ed.). S. Chand.

3. BillmeyerJr, F. W. (2007).*Textbook of polymer science* (3rd ed.). John Wiley & Sons.
4. Haghi, A. K., Mercader, A. G., Balkoese, D., &Mukbaniani, O. V. (2021).*Applied chemistry and chemical engineering*, (1st ed.). CRC Press, Taylor & Francis Group.
5. Skoog, D. A., West, D. M., Holler, F. J.,&Crouch, S. R. (2022).*Fundamentals of analytical chemistry* (10th ed.). Cengage.
6. Fontana, M. G. (2017). *Corrosion engineering* (3rd ed.). McGraw-Hill Education.
7. Taylor, H. F. W. (1997). *Cement chemistry* (2nd ed.). Thomas Telford.

Web Resources:

- https://www.sciencedirect.com/topics/chemistry/electrochemistry
- https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry 20.7: Batteries and Fuel Cells - Chemistry LibreTexts
- https://pesjournal.net/journal/v3-n1/2.pdf
- https://www.researchgate.net/publication/275028997_Corrosion_and_Corrosion_Control
- https://www.snexplores.org/article/explainer-what-are-polymers
- https://books.google.co.in/books/about/Glass_Chemistry.html?id=2yTyCAAAQBAJ&redir_esc=y
- https://kdmfab.com/alloy-steel/
- https://www.mdpi.com/2076-3417/13/1/203
- https://www.rhimagnesitaindia.com/blog/major-types-of-refractories,-characteristics,-and-their-applications-/26
- https://tameson.com/pages/lubricants
- https://www.toppr.com/guides/geography/mineral-and-energy-resources/composite-materials-definition-and-its-types/

24BY101
Biology for Engineers

Course Category:	**Basic Sciences**	**Credits:**	**3**
Course Type:	**Theory**	**Lecture-Tutorial-Practice:**	**3-0-0**
Pre-requisites:	**-**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**40** **60** **100**

Course Description:

The course introduces engineering students to key concepts in biology essential for understanding biological systems and their integration into engineering practices. It covers a wide range of topics from basic biological principles to advanced applications in biomedical engineering, bio materials, synthetic biology, and bioinformatics.

Course Objectives:

1. Introduce engineers to foundational concepts in biology essential for understanding biological systems and their relevance to engineering applications.
2. Explore the properties and behavior of biomaterials and biomechanics principles that influence the design and functionality of biomedical devices.
3. Investigate bio-inspired design principles, synthetic biology techniques, and biotechnological applications for engineering innovation.
4. Explore bioinformatics tools and systems biology approaches to analyse complex biological data and understand biological systems at a molecular and cellular level.
5. Investigate advanced topics in biological engineering, such as Nano biotechnology, regenerative medicine, or emerging biotechnologies, to expand students' knowledge and skills.

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes	BTL
CO1	demonstrate a fundamental understanding of basic biological principles, such as cell biology, genetics, and physiology, and their application in engineering contexts.	K3
CO2	analyse and evaluate biomaterials based on their mechanical properties and design biomedical devices using biomechanical principles.	K4
CO3	apply bio-inspired design principles and synthetic biology techniques to propose innovative engineering solutions and understand their practical applications in biotechnology.	K3
CO4	develop proficiency in using bioinformatics tools, constructing computational models, and applying systems biology approaches to study and interpret biological data and systems.	K3
CO5	critically analyse and evaluate current research trends and innovations in advanced areas of biological engineering, demonstrating the ability to apply advanced concepts in real-world engineering scenarios.	K4

Course articulation matrix

COs	POs										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	-	-	-	-	-	-
CO2	-	2	1	3	-	-	-	-	-	-	-
CO3	-	-	2	-	3	-	-	-	-	-	-
CO4	-	-	2	3	-	-	-	-	-	-	-
CO5	-	3	-	-	-	2	-	-	-	-	-

(1-Low, 2 -Medium, 3–High) (WK1)

Course Content

Unit-I
Introduction to Biology for Engineers

- Overview of interdisciplinary nature and importance of biology for engineers
- Basic biological concepts relevant to engineering applications
- Introduction to engineering challenges addressed by biology-inspired solutions
- Introduction to the structure and functions of Biomolecules

Unit-II
Biomaterials and Biomechanics

- Properties and applications of biomaterials in engineering (e.g., tissue engineering, drug delivery systems)
- Biomechanical principles applied to engineering (e.g., mechanics of bones and joints, biomechanics of tissues)
- Case studies: Design and development of biomaterials for medical implants, prosthetics, and tissue engineering

Unit-III
Bio inspired Design, Synthetic Biology and Biotechnology

- Introduction to bioinspired design, biomimicry, synthetic biology and genetic engineering (Genetically modified Crops & Animals)
- Examples of biological systems inspiring engineering innovations (e.g., bird flight, gecko adhesion, shark skin, human eye camera)
- Applications of biotechnology in engineering (e.g., bioprocessing, bioremediation, biosensors)

- Case studies: Biomimetic design in robotics, materials science, architecture, Development of biofuels, bioplastics, and biopharmaceuticals

Unit-IV
Bioinformatics and Systems Biology

- Introduction to bioinformatics tools and databases
- Engineering applications of bioinformatics (e.g., genome sequencing, protein structure prediction, drug discovery)
- Systems biology approaches to understanding complex biological systems and networks
- Case studies: Computational modelling of biological systems, personalized medicine, and synthetic biology

Unit-V
Advanced Topics in Biology for Engineers

- Emerging trends and cutting-edge research in biology for engineers
- Advanced applications and case studies in specific engineering fields (e.g., nanotechnology, energy, environmental engineering)
- Ethical considerations (Bio-Safety) and societal implications (Biopiracy & Bio patent)

Text Books:

1. Johnson, A. T. (2011). Biology for Engineers. CRC Press.
2. Renneberg, R. (2017). Biotechnology for Engineers: Biological Processes and Technologies (1st ed.). Elsevier.
3. Mount, D. W. (2004). Bioinformatics: Sequence and Genome Analysis (2nd ed.). Cold Spring Harbor Laboratory Press.

Reference Books:

1. Enderle, J., & Bronzino, J. (2011). Introduction to Biomedical Engineering (3rd ed.). Academic Press.
2. Ratner, B. D., Hoffman, A. S., Schoen, F. J., & Lemons, J. E. (2012). Biomaterials Science: An Introduction to Materials in Medicine (3rd ed.). Academic Press.
3. Benyus, J. M. (2002). Biomimicry: Innovation Inspired by Nature. Harper Perennial.

Web Resources:

1: Introduction to Biology for Engineers (https://archive.org/details/biologyforengine0000john)

2: The Interdisciplinary Role of Biology in Engineering (https://onlinecourses.nptel.ac.in/)
3: Biomaterials in Engineering (https://link.springer.com/book/10.1007/978-3-031-35832-6)
4:Biomechanics Principles (https://www.cambridge.org/core/books/introductory biomechanics/79733231375F00B75C84A47CCABB9386)
5: Bioinspired Design (https://link.springer.com/article/10.1007/s00163-020 00333-w)
6:BiomimicryApplications(https://www.cambridge.org/core/books/abs/bioinspired-structures-and design/bioinspired-and-biomimetic-design-of-multilayered-and-multiscale structures/D14F3C8BD06061B5983B7DAB55D6B1FA)
7: Fundamentals of Synthetic Biology (https://www.nature.com/subjects/synthetic-biology) Resource 8: Biotechnology Applications (https://open.umn.edu/opentextbooks/textbooks/820)
8: Bioinformatics Tools and Databases (https://microbenotes.com/bioinformatics-databases-software-tools/)
9: Systems Biology Approaches (https://link.springer.com/protocol/10.1007/978-981-99-6913-5_9)
10: Emerging Trends in Bioengineering (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7392392/)
11: Advanced Applications in Bioengineering (https://ibecbarcelona.eu/about-us/applications-in-bioengineering/)
12: Ethical Considerations in Biotechnology (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6612373/)

COURSE CODE: 24CS102
PROGRAMMING USING C

Course Category:	Engineering Science (ES)	**Credits:**	3
Course Type:	Theory	**Lecture -Tutorial-Practice:**	3-0-0
Pre-requisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	40 60 100

Course Description

This course introduces foundational programming concepts, covering algorithms, flowcharts, and pseudo code. It explores the C language structure, data types, operators, control structures, loops, arrays, strings, and functions. Advanced topics include pointers, dynamic memory allocation, structures, unions, enumerations, and file handling. Students gain hands-on experience with inter-function communication, recursion, sorting/searching techniques, and memory management. The course emphasizes practical coding skills, problem-solving, and program design, providing a solid foundation for software development using the C language.

Course Objectives

- *To introduce students to the fundamentals of computer programming.*
- *To provide hands-on experience with coding and debugging.*
- *To foster logical thinking and problem-solving skills using programming.*
- *To familiarize students with programming concepts such as data types, control structures, functions, and arrays.*
- *To encourage collaborative learning and teamwork in coding projects.*
- *To evaluate and apply C programming techniques proficiently for searching and sorting.*

Course Outcomes

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

	Course Outcomes	BTL	POI
CO1	Understand fundamental programming concepts in C through algorithms, flowcharts, and selection statements.	**K2**	1.7.1,2.5.1, 2.5.2, 2.7.1
CO2	Develop efficient C programs using loops, arrays, and strings using control structures.	**K3**	1.7.1,2.5.1, 2.5.2, 2.6.3,3.5.1
CO3	Implement modular C programs using functions, pointers, and memory optimizations.	**K3**	1.7.1, 2.5.2, 2.6.3, 3.5.1, 5.4.1
CO4	Develop C programs using structures and unions for user defined data types.	**K3**	2.5.2, 2.6.3,3.5.1
CO5	Analyze the use of enumerations and file handling techniques in C to manage data efficiently and solve real-world programming problems.	**K4**	1.7.1,2.5.1, 2.5.2, 2.6.3,3.5.1

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2											
CO2	3	3	2									2	2
CO3	2	2	2		2							2	2
CO4	2	2	2									2	2
CO5	2	2	2									2	2

(1- Low, 2 - Medium, 3 – High)

Unit-I : Introduction to C & Problem solving

Introduction to the C Language: Introduction to Programming Languages, Basics of a Computer Program, Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Background of C program, Identifiers, Types, Variables, Constants, Memory Layout, Input/Output, Programming Examples.

Structure of a C Program: Logical Data and Operators, Expressions, Precedence and Associatively, Evaluating Expressions, Type Conversion, Statements, Storage Class.

Selection: Two-way Selection, Multiway selection, More Standard Functions.

Unit-II: Repetition, Arrays & Strings

Repetition: Concept of Loops in C, Loop Examples, the Calculator Program.

Arrays: Array Concepts in C, Inter-Function Communication, Array Applications, One Dimensional Arrays, Linear Search and Binary Search Techniques, Selection Sort, Bubble Sort, Two Dimensional Arrays, Multidimensional Arrays.

Strings: String Concepts, C Strings, String Input/output Functions, Arrays of Strings, String Manipulation Functions, String- Data Conversion.

Unit-III: Functions, Pointers & Memory Allocations

Functions: Functions in C, User Defined Functions, Call by Value, Call Value Reference, Inter-Function Communication, Standard Functions, Scope, Recursion and advantages.

Pointers: Introduction to Pointers, Pointers for Inter-Function Communications, Pointers to Pointers, Compatibility, Lvalue and Rvlaue. Arrays and Pointers, Pointers Arithmetic and Arrays, Passing an Array to a Function, Array of Pointers.

Memory Allocation: Need of dynamic memory allocation, malloc(), calloc(), free(), realloc(), NULL, Stack vs. Heap Allocation.

Unit-IV: Structures & Unions

Structures: Structure Type Declaration, Initialization, Accessing Structures, Operations on Structures, Complex Structures, Structures and Functions, Sending the Whole Structure, Passing individual structure members, passing structure via pointer, nested structure.

Unions: Referencing Unions, Initializers, Unions and Structures, Internet Address, Programming Applications.

Unit-V: Enumerations & Files

Enumerations: The Type Definition (Typedef), Enumerated Types: Declaring an Enumerated Type, Operations on Enumerated Types, Enumeration Type Conversion, Initializing Enumerated Constants, Anonymous Enumeration: Constants, Input/Output Operators.

Files: introduction to the files, Uses of Files, Text files Vs. Binary files, Opening and closing FILE , Modes of FILE operation, Command line arguments, Standard Library Input /Output functions ,Character i/o functions, File Handling functions.

Text Books:

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988
2. Behrouz A. Forouzan and Richard F. Gilberg, “Computer Science A Structured Programming Approach Using C”, CENGAGE Learning, Third Edition.
3. Schaum’s Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996

Reference Books:

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition
4. Horowitz Sahni and Anderson-Freed, “Fundamentals of Data Structures in C”, 2nd edition, Universities Press, 2011

Web Resources:

1. NPTEL, "NOC: Introduction to Programming in C," [Online]. Available: https://nptel.ac.in/courses/106/104/106104128/. [Accessed: Feb. 25, 2025].
2. Coursera, "C for Everyone: Structured Programming," [Online]. Available: https://www.coursera.org/learn/c-structured-programming/. [Accessed: Feb. 25, 2025].
3. GeeksforGeeks, "Arrays, Pointers and Functions in C," [Online]. Available: https://www.geeksforgeeks.org/arrays-and-pointers-functions-in-c/. [Accessed: Feb. 25, 2025].
4. GeeksforGeeks, "C Enumerations," [Online]. Available: https://www.geeksforgeeks.org/enumeration-enum-c/. [Accessed: Feb. 25, 2025].

5. Codeforwin, "Understanding malloc, calloc, realloc, and free," [Online]. Available: https://codeforwin.org/2018/07/malloc-calloc-realloc-free-functions-c-programming.html. [Accessed: Feb. 25, 2025].
6. GeeksforGeeks, "Unions in C," [Online]. Available: https://www.geeksforgeeks.org/union-c/. [Accessed: Feb. 25, 2025].
7. Programiz, "Structures in C," [Online]. Available: https://www.programiz.com/c-programming/c-structures. [Accessed: Feb. 25, 2025].
8. TutorialsPoint, "Formatting Input/Output Functions and Character Input/Output Functions," [Online]. Available: https://www.tutorialspoint.com/cprogramming/c_file_io.htm. [Accessed: Feb. 25, 2025].
9. Programiz, "Command-Line Arguments," [Online]. Available: https://www.programiz.com/c-programming/c-command-line-arguments. [Accessed: Feb. 25, 2025].
10. W3Schools, "C Programming Language," [Online]. Available: https://www.w3schools.com/c/index.php. [Accessed: Feb. 25, 2025].

COURSE CODE: 24CS181
PROGRAMMING USING 'C' LAB

Course Category:	Engineering Science (ES)	**Credits:**	1.5
Course Type:	Practical	**Lecture -Tutorial-Practice:**	0-0-3
Pre-requisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	60 40 100

Course Description

This hands-on course introduces students to the foundational principles of the C programming language, integrating essential Linux command-line skills and compiler tools such as GCC and Turbo C. The course emphasizes problem-solving, logical thinking, and algorithm development. Students will work through a structured progression from simple input/output to complex file operations and data structures, including practical projects and assignments.

Course Objectives

The primary objective of this C Programming Lab course is to provide hands-on practical experience in writing, debugging, and executing C programs. It aims to develop students' understanding of fundamental programming concepts such as input/output operations, control structures, arrays, strings, functions, and pointers through practical exercises. By the end of the course, students will be proficient in using essential C programming tools, developing logical problem-solving skills, and applying programming concepts to build efficient programs in a Linux environment using compilers like Turbo C and GCC.

Course Outcomes

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

	Course Outcomes	BTL	POI
CO1	Understand basic Linux shell commands to compile and run C programs using GCC.	**K2**	1.7.1,2.5.1, 2.5.2, 2.7.1
CO2	Select the right control structure for solving the problem.	**K3**	1.7.1, 2.5.1,2.5.2, 2.6.3,3.5.1
CO3	Develop C programs which utilize memory efficiently using programming constructs like pointers.	**K3**	1.7.1, 2.5.2, 2.6.3,3.5.1 5.4.1
CO4	Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.	**K3**	2.5.2, 2.6.3,3.5.1
CO5	Analyze the use of enumerations and file handling techniques in C to manage data efficiently and solve real-world programming problems.	**K4**	1.7.1, 2.5.1,2.5.2, 2.6.3,3.5.1

Contribution of Course Outcomes towards achievement of Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	2	2											
CO2	3	2	3									2	2
CO3	3	2	3		2							2	2
CO4	3	2	3									2	2
CO5	2	3	3									2	2

(1- Low, 2 - Medium, 3 – High)

Course Content:

WEEK- 1

1. Basic Linux environment and its editors like Vi, Vim & Emacs etc.

2. Exposure to Turbo C, gcc

3. Write a C program to print the following output Input:

Enter a Character: *
Enter a Number: 1
Output:

```
* * * * * * *
*       1     *
*       1     *
*       1     *
*       1     *
*     1 1 1   *
* * * * * * *
```

4. Write a C program that takes two numbers and an arithmetic operator (+, -, *, or /) as input from the user using scanf(), performs the corresponding operation, and displays the result using printf().

5. Write a C program that reads two numbers from the user using `scanf()`, and then swaps their values using both methods:

1. With a third variable 2.Without using a third variable

Finally, display the swapped values using `printf()`.

.

6. Declare three variables of integer data type. User has to input three valid numbers. Display Sum and average of user entered numbers.
Approach is to take three numbers and find their sum and average using the formula given below-

Sum: a+b+c
Average: (a+b+c)/3
Where a,b,c are the three numbers.
Sample Input:
Enter 3 Values: 10 20 30
Sample Output: Sum: 60 Average: 20

WEEK-2

1. Input the temperature in Fahrenheit and output the equivalent temperature in Celsius and Vice – Versa. Input two numbers. The first is for a Celsius value, and the second is for a Fahrenheit value. Input Celsius value, convert it to Fahrenheit. Use the formula F = C*9/5 + 32 for conversion. In case of decimals, show up to 1 decimal value.
Input the Fahrenheit value, convert it to Celsius.
Use the formula C= (F−32)×5/9 for conversion. In case of decimals, show up to 1 decimal value.
Sample Input: 0 100
Sample Output: 32 37.7

2. You can calculate a Simple Interest by just providing the Principle Amount, Rate of Interest and Time or Periods provided by the user input. We can calculate the Simple Interest by the using the below Formula.

Simple Interest = (Principal*Rate*Time)/100

Principal (P): The principal is the amount that was initially borrowed (loan) from the bank or invested.

Rate (R): It is the rate of interest at which the principal amount is given to someone for a certain time; the rate of interest can be 5%, 10%, or 13%, etc.

Time (T): Time is the duration for which the principal amount is given to someone.

Constraints: 1<=Principal<=10000 1<=Rate<=10

1<=T<=30

Sample Input: 100 3 10

Sample Output: 30

3. You are working on a program that tracks the daily sales of a small bookstore. The owner wants to calculate the total sales and average sales for three consecutive days to better understand business trends. Write a program that takes the sales figures for three days as input, calculates the total sales, and finds the average sales. How will you implement this in C?

4. Write a C program to evaluate and display the result of the following expressions. Use the given variable declarations and initialize them with appropriate values. Also, print the results of each expression.

- A+B*C+(D*E) + F*G
- A/B*C-B+A*D/3
- A+++B---A
- J= (i++) + (++i)

5. Write a C program to calculate electricity bill according to the given condition:

For first 50 units Rs. 0.50/unit

For next 100 units Rs. 0.75/unit

For next 200 units Rs. 1.20/unit

For unit above 250 Rs. 1.50/unit

An additional surcharge of 20% is added to the bill.

WEEK- 3

1. To find factorial of the any given positive number. The factorial of a positive number n is given by: 1*2*3*4 ...Note: This program should take a positive integer from the user as the factorial of a negative number doesn't exist and, the factorial of 0 is 1. Compute the factorial using any loop. Since the factorial of a number
may be very large, the type of factorial variable is declared as unsigned long. If the user enters a negative number, the program should display a custom error message.

2. Input a number, check the given number is a prime or not. A prime number should be a natural number greater
than 1 that has no positive divisors other than 1 and itself.
Test Data and Output: Enter n: 5
Output: Prime
Enter n: 6
Output: Not Prime

3. Checking a number palindrome. Number should be a positive integer having more than one digit as all the single digits are palindromes.
Test Data and output:
Input : 2002 Input: 1234
Output: true Output: false

4. Construct a pyramid of numbers. A pyramid of numbers represents the number of individuals per unit area of various trophic areas where producers are kept at the base and the tip is occupied by top carnivores.

The pyramid of numbers is mostly upright. The members of successive higher trophic levels are higher than the previous one.

1. A higher trophic level has fewer individuals than that of the lower trophic levels.

1

2 2 2

3 3 3 3 3

4 4 4 4 4 4 4

5 5 5 5 5 5 5 5 5

5.Develop a C program that takes an integer as input from the user and prints 'Yes' if the number is an Armstrong number, and 'No' otherwise.(This adds specific input/output requirements.)

WEEK- 4

1. Write a C program to delete all duplicate elements from an array.
The program should:

- Ask the user to enter the number of elements in the array.
- Accept the array elements from the user.
- Remove all duplicate values from the array.
- Display the new array with only unique elements.

2. Write a C program to insert an element into a specific position in an array.
The program should:

- Ask the user to enter the size of the array and its elements.
- Ask the user to enter the element to insert and the position at which it should be inserted.
- Insert the element at the specified position by shifting the existing elements.
- Display the updated array.

3. Find 2's complement of the given binary number.
To get 2's complement of a binary number, simply invert the given number and add 1 to the least significant bit (LSB) of given result.
Test Data and Output:
Find 2's complement of binary number 10101110.
Simply invert each bit of given binary number, which will be 01010001. Then add 1 to the LSB of this result, i.e., 01010001+1=01010010 which is answer.
Find 2's complement of binary number 10001.001.
Simply invert each bit of given binary number, which will be 01110.110 Then add 1 to the LSB of this result, i.e., 01110.110+1=01110.111 which is answer.

4. Write a C program to sort array elements in ascending or descending order.

5. Given an array of integers **nums** and an integer **target,** return indices of the two numbers such that they add up to target. You may assume that each input would have exactly one solution and you may not use the same element twice. You can return the answer in any order.
Sample Input:
Enter the size of an array: 4
Enter array elements: 2 7 11 15
Enter target: 9
Output: [0,1]

WEEK- 5

1. A matrix can only be added to another matrix if the two matrices have the same dimensions. To add two matrices, just add the corresponding entries, and place this sum in the corresponding position in the matrix which results.
Input elements in 3x3 matrix1: 1 2 3
4 5 6
7 8 9
Input elements in 3x3 matrix2: 9 8 7
6 5 4
3 2 1
Sum of both matrix = 10 10 10
10 10 10
10 10 10

2. Matrix multiplication is a binary operation that produces a matrix from two matrices. For matrix multiplication, the number of columns in the first matrix must be equal to the number of rows in the second matrix. The resulting matrix, known as the **matrix product**, has the number of rows of the first and the number of columns of the second matrix. The product of matrices **A** and **B** is denoted as AB.

3. Concatenate two strings without using built-in functions
Note: User would be asked to enter two strings and then the program would concatenate them. For concatenation we have not used the standard library function strcat(), instead we have written a logic to append the second string at the end of first string.
Test Data and Output:
Str1: Good Str2: Morning Output: Good Morning

4. Reverse a string using built-in and without built-in string functions
Using built-in function: The function is used for reversing a string. The reversed string will be stored in the same string.

5. Input two strings **str1** in lowercase**, str2** in uppercase**.** Print the lower case string **str1** in uppercase and the uppercase string **str2** in lowercase.

WEEK- 6

1. Write a C program using a user-defined function to find the biggest number given any three numbers.

2. Write a **C program** to calculate the **factorial of a given number** using recursion. The program should prompt the user to enter a number and then compute its factorial using a recursive function.

3. Write a **C program** to generate the **Fibonacci series up to N terms** using a recursive function. The program should prompt the user to enter a number **N**, then compute and display the first **N Fibonacci numbers**.

4. Write a **C program** to swap two numbers using **call by value and call by reference**. The program should demonstrate that changes made inside the function do not affect the original values in the main function.

5. How can recursion be used to calculate NCR? Write a C program to demonstrate this.

WEEK- 7

1. String is a sequence of characters. Input two strings str1 and str2. Copy the contents of str1 to str2 using functions and pointers. Define a function copystr() with two pointer arguments copystr(*str1,*str2) Approach :
1. Scan string str from 0 to length-1.
2. check one character at a time based on ASCII values
- if(str[i] >= 65 and str[i] <=90), then it is uppercase letter,
- if(str[i] >= 97 and str[i] <=122), then it is lowercase letter,
- if(str[i] >= 48 and str[i] <=57), then it is number,
- else it is a special character

3. Print all the counters
Sample Input:
Enter a string: Programming
Sample Output:
String1: Programming
String2: Programming

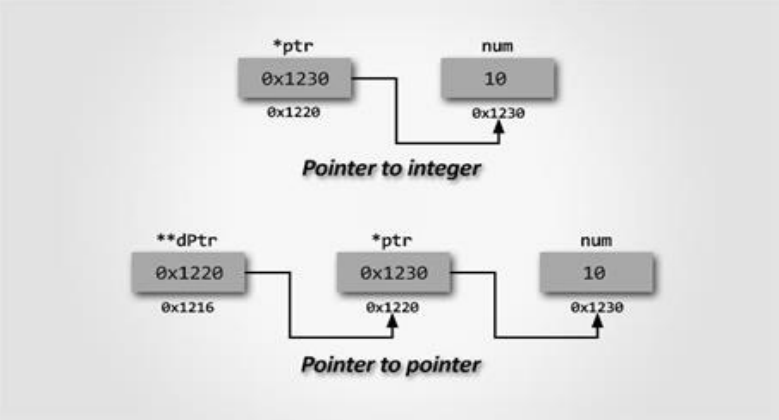
2. Given a string, write a program to count the occurrence of Lowercase characters, Uppercase characters, Special characters, and Numeric values. Define a function to count.
Input : #CseAi01dOr@gAIml07
Output :
Upper case letters : 5
Lower case letters : 8
Numbers : 4
Special Characters : 2
Input : *AiMlC4AiDsS*

Output :
Upper case letters : 6
Lower case letters : 4
Numbers : 1
Special Characters : 2

3. Write a c program to perform simple pointer arithmetic operations in c.

4. Write a c program to find sum of array elements by using array of pointers in c

5. When a pointer holds the address of another pointer then such type of pointer is known as pointer-to-pointer or double pointer. ptr is a normal pointer that holds the address of an integer variable num. There is another pointer **dptr in the diagram that holds the address of another pointer ptr, the pointer dptr here is a pointer-to-pointer (or double pointer). Demonstrate double pointers using the following representation.



WEEK- 8

1. Write a C program to define a structure named Student that contains the following members:

- name (character array)
- rollNumber (integer)
- age (integer)

Using a structures concept, store and display the details of two students.

.

2. Write a C program to define a structure named Student with the following members:

- name (character array) – to store the student's name.
- rollNumber (integer) – to store the roll number.
- marks (array of 3 integers) – to store marks obtained in 3 subjects.

Using an array of structures, read the details of two students from the keyboard. Calculate and display:

- Name of the student
- Roll number
- Marks in 3 subjects
- Total marks obtained

3. Write a C program to define a structure named Book with the following members:

- title (character array) – to store the book's title.
- author (character array) – to store the author's name.
- price (float) – to store the price of the book.

Using an array of structures, read the details of **five books** from the keyboard and display them in a formatted output.

4. Write a C program to define a structure **Student** that includes the following details:

- Name (character array)
- Roll Number (integer)
- Age (integer)
- Date of Birth (another structure with day, month, and year as integers)

Note: Student Details (with Date of Birth as a Nested Structure)

5. Write a C program to define a structure **Employee**, which contains the following details:

- **Employee Name** (character array)
- **Employee ID** (integer)
- **Salary** (float)

Additionally, the structure **Employee** should have a **nested structure Address**, which includes:

- **City** (character array)
- **State** (character array)
- **Pin Code** (integer)

The program should:

- Accept details of an employee, including their address.
- Display the entered details in a proper format.

Write the complete C program, including structure definition, input, and output statements.
Note: Employee Records (with Address as a Nested Structure)

WEEK- 9

1. Write a C program to demonstrate **passing individual structure members** to a function. Define a structure for a student with members: name, roll number, and marks. Pass individual members to a function to display the details.

2. Explain the concept of **passing an entire structure** to a function in C. Write a program to define a structure for an Employee with members: name, ID, and salary. Pass the entire structure to a function to display the details.

3. Define a union Data with members: i (integer), f (float), str (string). Write a program to assign and print values to each member of the union one by one. Observe what happens to the values.

4. Explain the concept of **passing a structure through pointers** in C. Write a program to define a structure for a Student with members: name, roll number, and marks. Pass the address of the structure to a function and display the student details using pointers.

5. Write a C program to **add two complex numbers**.

- Define a **structure** Complex with two members: real (to store the real part)
- imag (to store the imaginary part)
- Take input for two complex numbers from the user.

Perform the addition of the two complex numbers: Add the **real parts** separately.

- Add the **imaginary parts** separately.
- Display the **sum** of the two complex numbers in the form **(a + bi)**.

Sample output:
Enter first complex number: 3 2
Enter second complex number: 1 7
Sum: 4 + 9i

WEEK- 10

1. Write a C program that defines an enumeration for different car brands and asks the user to enter a number. Display the corresponding car brand.

2. Create an enum for traffic signals (Red, Yellow, Green). Write a function that takes an enum value as input and prints its meaning (e.g., Red → Stop).

3. Write a C program to store and process student data using dynamic memory allocation with calloc(). The program should:

- Allow the user to enter the number of students (n).
- Dynamically allocate memory for n students using calloc().
- For each student, input details such as **roll number, name, and marks**.
- Display the list of students who have **failed** (consider marks less than 40 as failed).

4. Write a C program to print the corresponding weekday name for a given integer value (1 to 7) using enumeration constants. The program should define an enum for the weekdays, take an integer input from the user, and display the corresponding weekday name. If the input is out of range, display an appropriate error message.

5. Write a C program to write and read text into a file.The program should prompt the user to enter a string and write it to a text file. Then, it should open the same file, read the content, and display it on the screen.

6. Write a C program to copy the contents of one file to another using command-line arguments. The program should accept the source filename and the destination filename as command-line arguments. It should read the contents from the source file and write them to the destination file. If the source file does not exist or an error occurs, display an appropriate error message.

Web Resources:

1. LinuxCommand.org, "Basic Linux Environment, Editors, Turbo C, GCC," [Online]. Available: https://linuxcommand.org/. [Accessed: Feb. 25, 2025].
2. Programiz, "Pattern Printing & Block Letters in C," [Online]. Available: https://www.programiz.com/c-programming/examples/pattern-printing. [Accessed: Feb. 25, 2025].
3. GeeksforGeeks, "Arithmetic Operations & Swapping Numbers," [Online]. Available: https://www.geeksforgeeks.org/swap-two-numbers-without-using-temporary-variable/. [Accessed: Feb. 25, 2025].
4. CodingCompiler, "Sum and Average of Numbers," [Online]. Available: https://codingcompiler.com/c-program-find-sum-average-three-numbers/. [Accessed: Feb. 25, 2025].
5. TutorialsPoint, "Reading and Printing Multiple Integers," [Online]. Available: https://www.tutorialspoint.com/cprogramming/c_arrays.htm. [Accessed: Feb. 25, 2025].
6. Programiz, "Mixed Data Types Input & Format Specifiers," [Online]. Available: https://www.programiz.com/c-programming/c-input-output. [Accessed: Feb. 25, 2025].
7. GeeksforGeeks, "Files in C," [Online]. Available: https://www.geeksforgeeks.org/basics-file-handling-c/. [Accessed: Feb. 25, 2025].

24ME181
ENGINEERING GRAPHICS

Course Category:	Engineering Sciences (ES)	**Credits:**	**2.5**
Course Type:	Tutorial & Practice	**Lecture-Tutorial-Practice:**	**0-1-3**
Pre-requisites:	**Nil**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**60** **40** **100**

Course Description:

This course introduces students to the principles and practices of engineering graphics using Computer- Aided Design (CAD) tools. This course covers Plane and Descriptive geometry, orthographic and isometric projections. Students will learn to create, modify, and analyze 2D and 3D drawings, focusing on applications in engineering.

Course Objectives:

- To familiarize students with CAD software and its application in technical drawing.
- To make students proficient in creating and editing 2D and 3D engineering drawings.
- To teach the drawing of plane curves and their applications
- To explain the projection of points, lines, Planes, and solids.
- To enable students to visualize and represent 3D objects through orthographic projections, isometric views and development of surfaces.
- To cultivate skills in preparing engineering drawings following standard conventions and practices.

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes	BTL
CO1	Construct plane curves and identify their applications.	K3
CO2	Draw orthographic projections of points, lines and planes	K3
CO3	Develop 2D drawings of solids and surfaces.	K3
CO4	Demonstrate proficiency in creating isometric projections.	K4
CO5	Identify the 3D objects through orthographic projections.	K4

Course articulation matrix

	POs											PSOs	
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2		2		2				2				1
CO2	2		2		2				2				1
CO3	2		2		2				2				1
CO4	2		2		2				2				1
CO5	2		2		2				2				1

(1-Low, 2 -Medium, 3–High)

Course Content

Unit-I

Plane Curves

- Construction of **Ellipse, Parabola and Hyperbola** (General method only)
- Construction of **cycloids & Involutes.**

Unit-II

Orthographic Projections:

- Projections of **Points.**
- Projections of **Lines** (First Angle Projection only)
- Projections of **Plane regular geometric figures**. (First Angle Projection only)

Unit-III

Projection of Solids and Development of Surfaces

- Projections of simple solids such as Cubes, Prisms, Pyramids, Cylinders and Cones with varying positions (Limited to Solid Inclined to one of the Reference planes)
- Development of surfaces of Right Regular Solids of Prism, Pyramid, Cylinder and Cone.

Unit-IV

Conversion to orthographic Projection

- Orthographic projection conventions.
- Conversion of Isometric views into orthographic projections

Unit-V

Conversion to Isometric Projection

- Isometric Projection Principles, Isometric Views of Objects.
- Conversion of Orthographic Projections into Isometric Views

Text Books:

1. Kulkarni, D. M., Rastogi, A. P., & Sarkar, A. K. (2009). Engineering graphics with AutoCAD, (revised ed.). PHI Learning Pvt. Ltd.

2. N.D. Bhatt "Engineering Drawing", Charotar Publishing House, Anand. 53rd Edition – 2019.

Reference Books:

1. Bethine. A. Fishel, Jay D. Helsel, (2014). Engineering Graphics with AutoCAD, Pearson Education.
2. CADFolks, (2023). AutoCAD 2023 for Beginners, CAD Folks Publications.
3. BasanthAgrawal& C M Agrawal," Engineering Drawing", McGraw Hill Education Private Limited, New Delhi.

Web Resources:

[1] https://www.onlinecourses.nptel.ac.in/noc20_me79/preview
[2] https://www.autodesk.com/education
[3] https://www.freecad.org
[4] https://ocw.mit.edu/

24CY181
Chemistry Lab

Course Category:	**Basic Sciences**	**Credits:**	**1**
Course Type:	**Practical**	**Lecture-Tutorial-Practice:**	**0-0-2**
Pre-requisites:	**10+2 Chemistry**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**60** **40** **100**

Course Description:

The course is designed for students of B.Tech., providing essential practical knowledge of Chemistry concepts relevant to their fields. This hands-on laboratory course provides the students with practical experience in applied chemical techniques and experiments. The course is useful for students to develop essential skills of proper handling of instruments and apparatus, accurate measurements and recording data, as well as interpretation of data to arrive at the correct conclusion. The course includes the experiments based on different instrumental techniques for the quantitative analysis of different solutions. Also, the course enlightens the students on preparation of polymers, and corrosion related experiments. Further, it focuses on the conventional method of quantitative determination of samples using volumetric method.

Course Objectives:

1. Enhance understanding of chemical principles involved in instrumental methods of chemical analysis.
2. Develop skills in handling analytical instruments that can measure various chemical parameters.
3. Promote critical thinking and problem-solving through the interpretation of data obtained from the instruments.
4. Familiarize students with advantages and limitations of instrumental methods of analysis compared to conventional volumetric analysis.
5. Explore the practical aspects of chemical processes involved in preparation of polymers, metallic coatings, etc.

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes	BTL
CO1	Demonstrate a comprehensive understanding of various instrumental methods of chemical analysis	**K3**
CO2	Analyse quantitatively different redox systems and neutralization systems using volumetric analysis	**K4**
CO3	Compare corrosion tendencies of different metals and their protection by surface coatings	**K4**

CO4	Apply theoretical knowledge and skills of preparation of polymers, complexes on substrates, adsorption processes, porosity, viscosity, etc.	**K3**

Course articulation matrix

	POs										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	3	-		1	-	-	-	-	-	-
CO2	2	3	-	1		-	-	-	-	-	-
CO3	2	3	-		1	-	-	-	-	-	-
CO4	2	3	-	1		-	-	-	-	-	-
CO5	2	3	-		1	-	-	-	-	-	-

(1-Low, 2 -Medium, 3–High) (WK1)

Course Content

Experiments common to all branches:

1. Determination of strength of acid in a lead-acid battery
2. Determination of strength of base using pH metric titration
3. Conductometric analysis of a base using a standard acid
4. Determination of ferrous iron by permanganometry
5. Comparison of corrosion rates of different metals/alloys
6. Preparation of Urea-formaldehyde resin
7. Determination of amount of iron in a solution by colorimetry
8. Chemistry of blueprinting
9. Adsorption of acetic acid on charcoal

Experiments for CE and ME branches:

1. Determination of total hardness of a water sample
2. Determination of calcium in Portland cement
3. Determination of porosity of a refractory material
4. Determination of viscosity of lubricating oil by Redwood viscometer

Experiments for ECE, EEE and EIE branches:

10. Determination of ferrous iron by dichrometry
11. Determination of ferrous iron by potentiometry
12. Verification of Lambert-Beer's law
13. Electroplating of copper on iron article

Experiments for CSE, AI and IT branches:

10. Determination of ferrous iron by dichrometry
11. Determination of ferrous iron by potentiometry
12. Conductometric analysis of mixture of acids
13. Preparation of conducting polyaniline from aniline

Text Books:

1. Mendham, J. (2009). *Vogel's Quantitative Chemical Analysis* (6th ed.). Pearson Education.
2. Theodore, J., & George Pope, F. (2021). *Elementary Practical Chemistry. Inorganic and Organic*(1st ed.). Legare Street Press.

Reference Books:

1. Akhil, N., Deepak, L., Atul, B.,&Chaudari, P.B. (2023).*Practical Manual of Inorganic, Organic and Medicinal Chemistry* (1st ed.). IP Innovative.
2. Venkateswaran, V.(2012). *Basic Principles of Practical Chemistry* (2nd ed.). S. Chand& Sons.

Web Resources:

1. https://nitm.ac.in/ckfinder/userfiles/files/CY%20151_Labmanual%20Chemistry%20B_Tech%201st%20year.pdf
2. http://icv-au.vlabs.ac.in/inorganic-chemistry/Water_Analysis_Determination_of_Physical_Parameters/
3. http://pcv-au.vlabs.ac.in/physical-chemistry/EMF_Measurement/
4. http://pcv-au.vlabs.ac.in/physical-chemistry/Determination_of_Viscosity_of_Organic_Solvents/
5. http://vlabs.iitb.ac.in/vlabs-dev/labs/nitk_labs/Environmental_Engineering_1/experiments/determination-of-chloride-nitk/simulation.html
6. https://chemcollective.org/vlabs

24ME182
WORKSHOP PRACTICE
(ME)

Course Category:	Engineering Science (ES)	**Credits:**	**1.5**
Course Type:	**Laboratory**	**Lecture-Tutorial-Practice:**	**0-0-3**
Pre-requisites:	**10+2 Physics**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**60** **40** **100**

Course Description: (Part-A)

This part of the course provides first-year engineering students with comprehensive hands-on experience in electrical systems, electronics, and computer science fundamentals. The course covers practical exercises in electrical wiring and circuit design, electronics component handling, and computer hardware and software configuration. Students will engage in activities such as electrical switching circuits, distribution board assembly, electronic component identification, and basic IoT (Internet of Things) projects. The course is designed to equip students with essential skills for diagnosing and constructing electrical and electronic systems, as well as understanding computer hardware and IoT applications.

Course Description: (Part-B)

This part of workshop practice course provides first-year mechanical engineering students with hands-on experience across multiple fundamental areas of engineering, including carpentry, welding, and mechanical components. The course is designed to develop practical skills and technical proficiency through targeted exercises in woodworking, metalworking, and mechanical assembly. Students will gain familiarity with essential tools and techniques, including woodworking tools and joinery, welding processes, and mechanical component handling. By engaging in these practical exercises, students will enhance their ability to apply theoretical concepts in real-world scenarios, laying a strong foundation for advanced engineering studies.

Course Objectives:

1. Understand the fundamentals of house wiring.
2. Familiarize with the various electronic components and PCB preparation
3. Apply the concepts of internet of things (IOT)
4. Familiarize with the modern manufacturing methods.
5. Understand the basic joints using wood and practice joining of metals using various types of welding and familiarize with various mechanical components such as gears,

Nuts and bolts.

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes	BTL
	PART -A	
CO1	Design, assemble, and test various electrical circuits, including stair case, two-way, and fan connections, and accurately measure electrical parameters such as voltage, current, power, and energy using digital meters.	**K3**
CO2	Identify and use electronic components (resistors, capacitors, diodes, switches) to construct and test a simple calling bell circuit, demonstrating understanding of circuit design and component functionality.	**K3**
CO3	Install and configure peripheral devices on a desktop system and apply basic IoT principles using an Arduino board to measure and interpret environmental data such as temperature, humidity, and distance.	**K3**
	PART -B	
CO4	Effectively use woodworking hand and power tools, and apply joinery techniques such as cross half lap and dovetail joints to produce precise and durable wood assemblies.	**K3**
CO5	Proficiently perform arc welding on lap, butt, and corner joints, as well as gas welding processes, while producing high-quality welds with proper safety and technique; additionally, carry out bench work operations such as drilling and tapping, and assemble mechanical components including gears, bearings, and springs, demonstrating competency in precision machining and mechanical assembly.	**K3**

Course articulation matrix

	POs										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1			**2**		**3**						
CO2			**2**		**3**						
CO3			**2**		**3**						
CO4			**2**		**3**						
CO5			**2**		**3**						

(1-Low, 2 -Medium, 3–High)

Course Content

PART –A

1. **Electrical Workshop Practice Exercises: (3hrs)**
   a) Stair case/Two-way /Gowdown Switching/Fan connection
   b) 3Φ Distribution board with fuse, MCB, two way switches, light indicator, 4 switches, fan regulator
   c) Measurement of voltage, current, power, Energy by using digital meters.

2. **Electronics Workshop Practice Exercises: (1 hr)**
   a) Familiarization of electronic components such as resistors, capacitors, diodes, and switches.
   b) Preparation of a simple calling bell circuit board and testing its operation.

3. **Computer science Workshop Practice Exercises: (2 hrs)**
   a) **Hardware components of a desktop system:** Peripheral Installation: Install and configure peripheral devices such as printers, scanners, and external hard drives.
   b) **Basics of Internet of things (IOT):** Demonstration of different components and pin configuration of Arduino board.
   c) To measure Temperature, humidity and distance using Arduino board.

4. **Modern Manufacturing methods:** Demonstration of 3-D printing process.

PART –B Branch specific (For ME students only)

5. **Carpentry Workshop Practice Exercises: (2 hrs)**
   a) Woodworking Tools Familiarization: Practice to work with woodworking hand tools and operations using power tools.
   b) **Joinery Techniques:** Practice various joinery techniques such as cross half lap and Dove tail joints.
   c) Practice to work with various wood adhesives and fasteners.
6. **Welding workshop practice exercises: (2 hrs)**
   a) Preparation of Lap, Butt & Corner joints using Arc Welding.
   b) Practice of Gas welding process.

7. **Introduction to Mechanical Components & operations: (3hrs)**

a) **Bench Work Techniques:** Practice to work with various materials like metals and plastics.
b) Practice of drilling, tapping, and reaming operations on the above materials.
c) **Mechanical Components:** Practice of assembling lap and butt joints with various types of bolts, nuts, screws and single, double studs.

- Practice to work with various types of mechanical components such as

d) Gears - Bevel, Spur, Helical and Worm.
e) Bearings – Ball, roller, plain, needle and flexure.
f) Springs – Compression, Extension, Conical, Torsion and leaf.

Text Books:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black,

Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai& Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition.
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. &Upadhyay P.A.; AtulPrakashan, 2021-22.

Web Resources:

1. https://dsceme.files.wordpress.com/2016/08/workshop-practice-manual-2016-17-1.pdf
2. https://www.protosystech.com/rapid-prototyping.htm
3. https://www.arduino.cc/en/Tutorial/Foundations
4. https://www.tutorialspoint.com/arduino/

24UC183
Sports and Yoga

Course Category:	**Mandatory (MC)**	**Credits:**	**0**
Course Type:	**Practical**	**Lecture-Tutorial-Practice:**	**0-0-3**
Pre-requisites:	**-**	**Continuous Assessment:** **Summative Assessment:** **Total Marks:**	**100** **-** **100**

Course Description:

The course is designed for first year B.Tech. students of all branches. It provides essential and applied knowledge of physical and mental health. Introducing the course is more crucial in the present days, particularly undergraduate students, who require awareness on their physical and mental health. With this focus, the course covers various aspects of physical fitness, wellness and lifestyle, fundamental aspects of anatomy, physiology in physical education, yoga and lifestyle, different types of sports, etc. Although, the basic theoretical aspects of sports and yoga are discussed, major focus will be on the practice of yoga asanas and participation in various sports by the students.

Course Objectives:

1. Make the students understand the importance of sound health and fitness principles as they relate to better health.
2. Expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about yoga, physical education, health and fitness.
3. Create a safe, progressive, methodical and efficient activity-based plan to enhance improvement and minimize risk of injury.
4. Develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health.

Course Outcomes:

At the end of the course, the students will be able to

CO	Course Outcomes	BTL
CO1	Apply the knowledge of physical activities and Hatha Yoga on himself/herself and practice them	**K3**
CO2	Understand basic skills associated with yoga and physical activities including strength, flexibility, balance and coordination	**K2**
CO3	Practice yoga asanas, pranayama and meditation in daily life for the health of body and balance of mind	**K3**
CO4	Apply correctly the biomechanical and physiological principles elated to exercise and training	**K3**

CO5	Practice techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance	**K3**

Course articulation matrix

	POs										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	-	-	-	-	-	-	**1**	**2**	-	-	**3**
CO2	-	-	-	-	-	-	**1**	**2**	-	-	**3**
CO3	-	-	-	-	-	-	**1**	**2**	-	-	**3**
CO4	-	-	-	-	-	-	**1**	**2**	-	-	**3**
CO5	-	-	-	-	-	-	**1**	**2**	-	-	**3**

(1-Low, 2 -Medium, 3–High) (WK8)

Course Content

Unit-I
Introduction to physical education, physical fitness, wellness and life style

- Meaning and definition of physical education, aims and objectives, changing trends in physical education.
- Meaning and importance of physical fitness and wellness, components of physical fitness.
- Components of health related fitness, components of wellness.
- Preventing health threats through lifestyle change and concept of positive lifestyle.
- Awards and honours in the field of sports in India (Dronacharya Award, Arjuna Award, Dhayanchad Award, Rajiv Gandhi Khel Ratna Award, etc.)

Unit-II
Fundamentals of anatomy, physiology, kinesiology, biomechanics and sports

- Meaning of anatomy, physiology and their importance in the context of physical education and sports.
- Effect of exercise on the functioning of various body systems like circulatory system, respiratory system, neuromuscular system, etc.
- Meaning and importance of kinesiology and biomechanics in physical education and sports, Newton's law of motion and its application in sports, friction and its effects in sports.
- Concept of postures, causes of bad posture, advantages of correct posture, advantages and disadvantages of weight training, common postural deformities – knock knee, flat foot, round shoulders, lordosis, kyphosis, bow legs and scoliosis.

Unit-III
Psychology in Sports

- Definition and importance of psychology in physical education and sports, differentiation between growth and development.
- Adolescent problems and their management, concept and types of emotions, control of emotions, meaning and types of aggressions in sports, psychological benefits of exercise.
- Anxiety and fear and their effects on sports performance, motivation – types and techniques, understanding stress and coping strategies.
- Concept and meaning of doping, prohibited substances and methods, side effects of prohibited substances.
- First aid – definition and objectives, sports injuries – classification, causes and prevention, management of injuries – soft tissue injuries and bone and joint injuries.

(Following subtopics related to any one game/sport of choice of student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, etc.: History of the game/sport, latest general rules of the game/sport, specifications of play fields and related sports equipment, important tournaments and venues, sports personalities, proper sports gear and its importance.)

Unit-IV
Theoretical aspects of Yoga and practice of Asanas

- Meaning, history and basic concepts of yoga, three bodies of human system, panchakoshas, trigunas, and ashtanga yoga.
- Meaning of asanas, practice of sukshma vyayama (warm up for asanas), asanas as preventive measures, practice of various asanas in the four categories – standing, sitting, prone and supine – at least 5 postures from each category, variations, contraindications and benefits of the asanas, Sun salutations.
- Asanas for hypertension, back pain, diabetes, asthama, obesity, etc.

Unit-V
Theory and practice of pranayama and meditation

- Meaning of pranayama, instructions for practice of pranayama, practice of various pranayama techniques – abdominal breathing, kapalabhati, anulom-vilom pranayama, bhramari, etc.
- Relaxation techniques for improving concentration – Yognidra
- Meaning of meditation, difference between concentration and meditation, various meditation methods, heartfulness meditation practice, benefits of meditation.

Text Books:

1. Modern trends and physical education – Prof. Ajmer Singh.
2. Light on Yoga – B.K.S. Iyengar.

Reference Books:

1. Health and Physical Education – NCERT (11^{th} and 12^{th} Classes).
2. Light on Pranayama – B.K.S. Iyengar.

Web Resources:

1. https://ncert.nic.in/textbook/pdf/iehp103.pdf
2. https://www.physio-pedia.com/Biomechanics_In_Sport
3. https://en.wikipedia.org/wiki/Sport_psychology
4. https://www.physio-pedia.com/Principles_of_Yoga
5. https://ncert.nic.in/pdf/publication/otherpublications/tiyhwlups1.pdf
6. https://heartfulness.org/global
7. https://www.biharyoga.net/asana-and-pranayama.php