B.Tech (Mechanical Engineering) Course Structure –R20
(w.e.f the Academic Year 2020-21)

Semester – 0

S. No.	Course code	Course Title	Category	L	T	P	Credits
1	R20BSH-HM1001	Physical Activities (Sports, Yoga and Meditation, Plantation)	BS	0	0	3	0
2	R20CSE-ES1001	Career Counseling	ES	3	0	0	0
3	R20CSE-ES1002	Orientation (Know your Department)	ES	3	0	0	0
4	R20CSE-ES1003	Fundamentals of Computers	ES	3	0	2	0
5	R20BSH-MA1001	Basic Aptitude and Mathematical Skills	BS	3	0	0	0
6	R20BSH-MA1002	Remedial Training in Foundation Courses	BS	5	0	0	0
7	R20BSH-HM1002	Human Values & Professional Ethics	HM	3	0	0	0
8	R20BSH-HM1003	Communication Skills (Listening, Speaking, Reading skills Writing skills)	HM	2	1	2	0
			Total	22	1	7	0

I Year - I Semester

S. No.	Course code	Course Title	Category	L	T	P	Credits
1	R20BSH-EN1101	Communicative English	HM	2	0	2	3
2	R20BSH-MA1101	Numerical Method and Ordinary Differential Equations	BS	3	0	0	3
3	R20BSH-CH1103	Engineering Chemistry	BS	3	0	0	3
4	R20CSS-ES1101	Computer Programming in C	ES	3	0	0	3
5	R20MEC-ES1102	Engineering Graphics	ES	1	0	4	3
6	R20BSH-CH1106	Engineering Chemistry Lab	BS	0	0	3	1.5
7	R20MEC-ES1103	Engineering Workshop & IT Workshop Lab	ES	0	0	3	1.5
8	R20CSS-ES1103	Computer Programming in C Lab	ES	0	0	3	1.5
9	R20BSH-MC1101	Environmental Science	MC	3	0	0	0
			Total	15	0	15	19.5

I Year - II Semester

S. No.	Course code	Course Title	Category	L	T	P	Credits
1	R20BSH-MA1201	Linear Algebra and Multivariable Calculus	BS	3	0	0	3
2	R20MEC-ES1203	Material Science and Engineering	ES	3	0	0	3
3	R20BSH-PH1203	Engineering Physics	BS	3	0	0	3
4	R20MEC-ES1202	Engineering Mechanics	ES	3	0	0	3
5	R20EEE-ES1201	Basic Electrical & Electronics Engineering	ES	3	0	0	3
6	R20BSH-EN1201	Communicative English Lab	HM	0	0	3	1.5
7	R20BSH-PH1205	Engineering Physics Lab	BS	0	0	3	1.5
8	R20EEE-BS1204	Basic Electrical and Electronics Engineering Lab	ES	0	0	3	1.5
			Total	15	0	9	19.5

S. No.	Course code	Course Title	Category	L	T	P	Credits
1	R20BSH-EN1101	Communicative English	HM	2	0	2	3

Course Objectives:
- Educate students in the acquisition of the English language through the study of literature and other contemporary forms of culture to understand the complex dynamics of human interpersonal relationships.
- Promote the development of empathy by engaging students in a discussion of literary works, highlighting the emotional aspects of the pieces for intellectual flexibility, creativity, and cultural literacy cultivating life-long learning.
- Acquire a wide range of vocabulary, an understanding of grammar and knowledge to demonstrate students' ability to think creatively in order to express effectively.
- Adopt activity-based teaching-learning methods to ensure that learners would be engaged in the use of language both in the classroom and laboratory sessions.
- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
- Help improve speaking skills through participation in activities such as role-plays, discussions and structured talks/oral presentations

Course Outcomes:
At the end of the course, the student will be able to:
1. Understand the value of Human Conduct for career development through life skills: Ethics & Values and use root words and Prepositions without errors. Gain reading skills for comprehension, specific information, gist, and pleasure through extensive reading. Enhance pronunciation with befitting tone for clarity in a speech to communicate language effectively.
2. Observe the significance of imagery in poetry to use it in real-time contexts and learn to use and misuse of Articles, Prefixes, Suffixes, and Punctuations. Gain reading skills for comprehension, specific information, gist, and pleasure through extensive reading. Participate in short conversations in routine contexts on topics of interest and ask questions and make requests politely.
3. Acquire conversation skills through drama and enhance the correct use of Nouns, Pronouns, Verbs and Concord to write paragraphs effectively. Gain reading skills for comprehension, specific information, gist, and pleasure through extensive reading. Listen for specific information, gist, note-taking, note-making and comprehension and develop convincing and negotiating skills through debates.
4. Develop reading for inspiration, interpretation & innovation and learn to use modifiers, synonyms and antonyms to write essays effectively. Gain reading skills for comprehension, specific information, gist, and pleasure through extensive reading
5. Learn meaningful use of language by avoiding meaningless cliches, bureaucratic euphemisms and academic jargon in order to acquire the skill of summarising.Gain reading skills for comprehension, specific information, gist, and pleasure through extensive reading

Unit I

Theory:
On the Conduct of Life: William Hazlitt: **Reading**; **Grammar**-Prepositions; **Vocabulary**-Word Formation-I; Introduction to Word Formation; **Writing**-Clauses and Sentences; **Life-Skills**: Values and Ethics. If-- Rudyard Kipling.
Wings of Fire" An Autobiography of Dr.APJ Abdul Kalam--1. Strong Roots--2.Early Influences-3.Education Provides a Solid Foundation-for Extensive reading-Reading for Pleasure-Information and General Understanding
Practice:
Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Learning Outcomes:
At the end of this unit, the student will be able to
- instill one's own creativity through poetry and prose for LSRW skills development(L3)
- build one's critical thinking skills (L3)
- enrich social skills which in turn make him/her a good engineer to the society(L3)
- impart reading skills that sensitize about worldly topics.(L2)
- understand new phrases and vocabulary to use in both communication and writing (L2)
- inculcate a sense of extensive reading and imbibe the habit of reading text independently.(L3)
- read to write effectively through a biography(L2)
- identify the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English (L3)
- ask & answer general questions on familiar topics (L2)

Unit II

Theory:
The Brook: Alfred Tennyson: Reading; Grammar-Articles; **Vocabulary**-Word Formation-II: Root Words from Other Languages; **Writing**-Punctuation; **Life-Skills**: Self-Improvement. How I Became a Public Speaker:George Bernard Shaw.
Wings of Fire" An Autobiography of Dr.APJ Abdul Kalam--4.Preparing to Start a Career--5.Work Begins in Earnest--6. From Hovercraft to Rockets **-**for Extensive reading**-**Reading for Pleasure-Information and General Understanding.

Practice:
 Listening: Answering a series of questions about the main idea and supporting ideas after listening to audio texts. **Speaking:** Discussion in pairs/ small groups on specific topics followed by short structured talks

Learning Outcomes:
At the end of this unit, the student will be able to
- experience literary imagery to use it in conversational English(L4)
- become aware of his/her responsibility towards nation(L2)
- understand his/her ability to write effectively through reading(L2)
- acquaint with perfect use of grammar and language(L3)
- inculcate a sense of extensive reading and imbibe the habit of reading text independently.(L3)
- read to write effectively through a biography(L2).
- comprehend short talks on general topics (L2)
- speak clearly on a specific topic using suitable discourse markers in informal discussions (L3)

Unit III

Theory:
The Death Trap: Saki: Reading; Grammar-Noun-Pronoun Agreement-Subject-Verb Agreement; **Vocabulary**-Word Formation-III: Prefixes and Suffixes from Other Languages; **Writing**-Principal of Good Writing-Paragraph Writing; **Life-Skills**: Time Management- On Saving Time: Seneca
Wings of Fire" An Autobiography of Dr.APJ Abdul Kalam--7.Adding Momentum to Space Research--8.Balancing Defence Technology with Space Research--for Extensive reading**-**Reading for Pleasure-Information and General Understanding.

Practice:
Listening: Listening for global comprehension and summarizing what is listened to.
Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed.

 Learning Outcomes:
At the end of this unit, the student will be able to
- instill empathy and a sense of humanity through the given literary piece (L3)
- acquire the ability to manage time in terms of goal setting (L3)
- communicate effectively with proper grammatical syntax and semantics (L3)
- understand new phrases and vocabulary to use in both communication and writing (L2)
- inculcate a sense of extensive reading and imbibe the habit of reading text independently.(L3)
- read to write effectively through a biography(L2)

- summarize the content with clarity & precision from short talks (L3)
- report what is discussed in informal discussions (L3)

Unit IV

Theory:

Chindu Yellamma: Reading; Grammar-Misplaced Modifiers;
Vocabulary-Synonyms & Antonyms; **Writing**-Essay Writing; **Life-Skills**: Innovations.
Muhammad Yunus.

Wings of Fire" An Autobiography of Dr.APJ Abdul Kalam--9. Dreaming of Satellites--10.The End of an Era--for Extensive reading-Reading for Pleasure-Information and General Understanding.

Practice:

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video. **Speaking:** Roleplays for the practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Learning Outcomes:

At the end of this unit, the student will be able to

- understand the significance of art that brings the change in human.(L2)
- construct sentences with appropriate usage of grammar.(L3)
- develop writing skills through essay writing. (L3)
- acquire a wide range of vocabulary through synonyms and Antonyms.(L2)
- inculcate a sense of extensive reading and imbibe the habit of reading text independently.(L3)
- read to write effectively through a biography(L2).
- infer & predict about the content of spoken discourse (L4)
- engage in formal/informal conversations understanding verbal & non-verbal features of communication (L3)

Unit V

Theory:

Politics and the English Language-George Orwell: Reading; Grammar-Cliches and Redundancies;
Vocabulary-Common Abbreviations; **Writing**-Writing a summary; **Life-Skills**: Motivation- The Dancer with a White Parasol: Ranjana Deva

Wings of Fire" An Autobiography of Dr.APJ Abdul Kalam--11. Leading a Team--12. Dear ones Pass On--for Extensive reading-Reading for Pleasure-Information and General Understanding.

Practice:

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. **Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides.

Learning Outcomes:

At the end of this unit, the student will be able to

- develop the Imagery techniques for speaking and writing. (L3)
- understand the gradual evolution in the field of Indian cinema. (L2)
- optimize the acquired skills of grammar and vocabulary contextually.(L3)
- inculcate a sense of extensive reading and imbibe the habit of reading text independently.(L3)
- read to write effectively through a biography(L2)
- take notes while listening to a talk/lecture to answer questions (L3)
- make formal oral presentations using effective strategies (L3)

Textbooks:

1. Language and Life -A skills Approach by Orient Black Swan.
2. Wings of Fire An Autobiography APJ Abdula Kalam with Arun Tiwari Abridged by Universities Press.

Suggested Books for Additional Reading

1. Technical Communication, Meenakshi Raman & Sangeeta Sharma, Oxford University Press
2. Effective Communication Skills, Kulbushan Kumar, Khanna Publishing House, Delhi
3. Communication Skills, Pushplata, Sanjay Kumar, Oxford University Press
4. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.

5. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
6. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
7. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.

Online References:

1. https://www.gradesaver.com/the-poetry-of-dh-lawrence/study-guide/summary
2. https://englicist.com/notes/summary-where-the-mind-is-without-fear-rabindranath-tagore.
3. http://www.authorstream.com/Presentation/cse1amity-2314117-stench-kerosene-amrita-pritam/.
4. https://www.poemhunter.com/poem/dream-love-8/comments/
5. https://www.poetryfoundation.org/collections

Sample Web Resources

Grammar/Listening/Writing
1-language.com
http://www.5minuteenglish.com/
 https://www.englishpractice.com/
Grammar/Vocabulary
English Language Learning Online
http://www.bbc.co.uk/learningenglish/
http://www.better-english.com/
http://www.nonstopenglish.com/
https://www.vocabulary.com/
BBC Vocabulary Games
Free Rice Vocabulary Game
Reading
https://www.usingenglish.com/comprehension/
https://www.englishclub.com/reading/short-stories.htm
https://www.english-online.at/
 Listening
https://learningenglish.voanews.com/z/3613
http://www.englishmedialab.com/listening.html
 Speaking
https://www.talkenglish.com/
BBC Learning English – Pronunciation tips
Merriam-Webster – Perfect pronunciation Exercises
All Skills
https://www.englishclub.com/
http://www.world-english.org/
http://learnenglish.britishcouncil.org/
 Online Dictionaries
Cambridge dictionary online
MacMillan dictionary
Oxford learner's dictionaries

Assessment Procedure: Theory

1. The formative and summative assessment procedures are to be adopted (mid exams and end semester examination).
2. Neither the formative nor summative assessment procedures should test the memory of the content of the texts given in the textbook. The themes and global comprehension of the units in the present day context with application of the language skills learnt in the unit are to be tested.
3. Only new unseen passages are to be given to test reading skills of the learners. Written skills are to be tested from sentence level to essay level. The communication formats—emails, letters and reports-- are to be tested along with appropriate language and expressions.

Examinations:

As part of communication practice, an activity based assessment is conducted through mid exams for 30 marks in the laboratory.

End semester exams are based on theory for 70 marks.

Assessment Procedure: Laboratory

1. Every lab session (100 minutes) should be handled by not less than two teachers (three would be ideal) where each faculty has to conduct a speaking activity for 20/30students.
2. The teachers are to assess each learner in a lab session for not less than 10 speaking activities.
3. As part of practice sessions of the whole semester in the lab, a minimum of 20 speaking activities should be conducted and each one is to be assessed for 10 marks or 10%. The average of any 10 activities'marks are scaled down to 10 in mid I and other 10 in mid
4. An Internal test is conducted for 10 marks.

S.No	Activity	Schedule	Evaluation	Final Marks
1	Spoken-1	After I Cycle	Each activity @ 1 Mark	10 Marks
2	Spoken-2	After II Cycle	Each activity @1 Mark	10 Marks
3	Spoken	Lab Internal	One activity @ 10 Marks	10 Marks

The rubric given below has to be filled in for all the students for all activities.

Body language (Gestures & Postures) (Eye Contact)	Fluency & Audibility	Clarity in Speech	Neutralization of accent	Appropriate Language (Grammar Accuracy & appropriate Vocabulary)	Total 10 marks	Remarks

S. No.	Course code	Course Title	Category	L	T	P	Credits
2	R20BSH-MA1101	Numerical Method and Ordinary Differential Equations	BS	3	0	0	3

Course Objectives:
- To familiarize the numerical techniques for solving non-linear equations, interpolation, differentiation, integration and ordinary differential equations.
- To enlighten the learners in the concept of ordinary differential equations.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Course Outcomes:
At the end of the course, the student will be able to
1. Solve non-linear equations using various numerical methods and apply numerical methods to find interpolation polynomial for a given data.(L2)
2. Apply numerical methods to evaluate derivatives and integration of a function and find the solutions of ordinary differential equations. (L3)
3. Solve the first order ordinary differential equations related to various engineeringfields. (L3)
4. Solve the higher order differential equation and analyze physical situations. (L3)
5. Apply the Laplace transform for solving differential equations and integral equations. (L3)

Unit I

Solution of Algebraic and Transcendental Equations: Bisection method, Regula - Falsi method, Iterative Method, Newton- Raphson method for one variable.Gauss Seidel method.
Interpolation: Finite differences, symbolic relations, Newton's forward and backward formulae, Gauss central difference formulae, Lagrange's difference formula.
Learning Outcomes:
At the end of this unit, the student will be able to
- find approximate roots of an equation by using different numerical methods. (L3)
- apply forward and backward interpolation formulae for equal intervals to find interpolating polynomial/values. (L3)
- applyLagrange's formulae for unequal intervals to find interpolating polynomial/values. (L3)

Unit II

Numerical Differentiation & Integration: Derivatives using forward & backward difference formulae, Trapezoidal rule and Simpson's 1/3rd and 3/8th rules.
Solutions of Ordinary differential equations:
Taylor's series method, Picard's method, Euler's and modified Euler's methods and Runge-Kutta method of fourth order.
Learning Outcomes:
At the end of this unit, the student will be able to
- apply numerical methods to evaluate derivatives and integration of a function. (L3)
- find the numerical solutions of ordinary differential equations using numerical methods. (L3).

Unit III

Differential Equations of first Order and First Degree: Linear, Bernouill's, exact differential equations and IF Methods.
Application: Newton's Law of cooling, orthogonal trajectories, simple electrical circuits.
Learning Outcomes:
At the end of this unit, the student will be able to
- solve the first order differential equation by appropriate method. (L2)
- apply suitable method to solve the real world problems using the concept of differential equations. (L3)

Unit IV

Linear Differential Equations of Higher Order: Complementary function, Particular integral (RHS e ^{ax}, Sin ax, cosax, polynomial in x, e ^{ax} V(x), xV(x)), Method of variation of parameters, simultaneous linear equations with constant coefficients.

Applications: L-C-R circuits.

Learning Outcomes:

At the end of this unit, the student will be able to

- solve the linear differential equations with constant coefficients by appropriate method. (L3)
- solve the higher order differential equation by analyzing physical situations. (L3)

Unit V

Laplace transforms(All Theorems without proofs): Definition, existence conditions, properties,Laplace transforms of derivatives and integrals, multiplication by t^n, division by t, periodic functions, unit step function and impulse function. Inverse Laplace transforms and convolution theorem.

Applications: improper integrals, ordinary differential equations and integral equations.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply the Laplace and inverse Laplace transforms for different types of functions. (L3)
- solve ordinary differential equations and integral equations by using Laplace transformation technique. (L3)

Textbooks

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44/e, 2017.
2. B.S. Grewal, Numerical Methods in Engineering & Science, Khanna Publishers, 2014.

References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
4. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.
5. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018.
6. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9/e, Wiley India, 2009.
7. Sastry, S.S, Introductory Methods of Numerical Analysis, 5th edition, , Prentice Hall , 2017.

S. No.	Course code	Course Title	Category	L	T	P	Credits
3	R20BSH-CH1103	Engineering Chemistry	BS	3	0	0	3

Course Objectives
- To familiarize various properties and applications of polymers.
- To impart knowledge on corrosion and its significance.
- To familiarize various properties of a good lubricant and to impart knowledge on preparation of synthetic petrol.
- To acquaint the students with types of soft and hard water and softening methods.
- To introduce different types of Nano materials and importance of green chemistry.

Course Outcomes:
- Illustrate the properties and applications of polymers. (L-2)
- Design the metallic materials to prevent the corrosion. (L-6)
- Assess the quality of fuels and identify the suitable one. (L-5)
- Analyze the suitable method for industrial water treatment. (L-4)
- Demonstrate the preparation, properties and applications of nano materials and importance of green chemistry. (L-2)

UNIT- I

HIGH POLYMERS: Polymerization Definition, Types of Polymerization-Addition and condensation polymerization, Stereo specific polymers, Plastics- Thermoplastics and Thermosetting plastics, Compounding of plastics, Molding of plastics- Compression molding, Injection molding, Extrusion molding and Transfer molding; Preparation, Properties and applications of Polyethylene (PE), Poly Vinyl Chloride (PVC), Urea-formaldehyde and Bakelite.

Applications:
- Polymers also used in automobile industries for making body panel, vision window.

Learning outcomes:
At the end of this unit, the students will be able to
- Identify preparation and properties of polymers. (L-3)
- Distinguish between thermoplastic and thermo setting resins. (L-4)

UNIT- II

CORROSION ENGINEERING: Introduction, Corrosion Definition, Theories of corrosion- Dry corrosion and Wet corrosion-Mechanism of wet corrosion by Oxygen absorption and Hydrogen evolution methods, Factors affecting rate of corrosion- nature of the metal and nature of the environment, Types of corrosion-galvanic corrosion, Differential aeration cell corrosion - water line corrosion, pitting corrosion, Control of corrosion-Cathodic Protection-Sacrificial anodic and impressed current cathodic protection.

Applications:
- To control corrosion of various machines used in large scale industries.
- Control of corrosion used to prevent the iron pipes, tables etc. by metallic coatings.

Learning outcomes:
At the end of this unit, the students will be able to
- Identify the various factors affecting corrosion. (L-3)
- Apply the principles of corrosion to control. (L-3)

UNIT- III

FUEL TECHNOLOGY AND LUBRICANTS:
Fuel Technology: Fractional Distillation of Petroleum- Manufacturing of Synthetic Petrol-Fischer-Tropschs & Bergius Process, Knocking, Anti Knocking Agents, Octane & Cetane Numbers.
Lubricants: Definition and functions of lubricants-classification of lubricants with examples - mechanism of lubrication – Thick film, Thin film and Extreme pressure lubrication, Properties of lubricants - Viscosity, flash and fire points, cloud and pour points, aniline points, neutralization number.

Applications:
1. The cracking method is used to increase the yield of gasoline.
2. Cetane and octane numbers are used to assess the quality of diesel and petrol respectively.

Learning Outcomes:

At the end of this unit, the students will be able to

- Select suitable fuels for IC engines (L3)
- Explain octane number and refining of petroleum (L2)

UNIT -IV

WATER TECHNOLOGY: Introduction to hardness of water, Indian standards and WHO standards of drinking water, Temporary and Permanent Hardness - Problems on Temporary and Permanent Hardness of water Estimation of Hardness by EDTA Method, Industrial water Treatment- Softening of water by Zeolite Process, Ion-Exchange Process, Desalination – Electro Dialysis, Reverse Osmosis.

Applications:

1. RO method is used for purification of water for drinking purpose.
2. Ion exchange method is used for de mineralization of water.

Learning outcomes:

At the end of this unit, the students will be able to

- Compare the quality of drinking water with BIS and WHO standards. (L-2)
- Demonstrate the Industrial water treatment processes. (L-2)

UNIT- V

ADVANCED TOPICS IN CHEMISTRY

Nanomaterials: Introduction – Preparation of Nanomaterials using sol-gel method, Types of Nanomaterials-Carbon Nano Tubes (CNT's) and Fullerenes-Preparation, Properties and Uses, Applications of Nanomaterials.

Green Chemistry: Introduction, 12 Principles of Green Chemistry, Green Synthesis-Aqueous phase extraction.

Applications:

1. Nano materials are used in paints, lubricants and medicine technology.
2. Green synthesis is used to make eco friendly reactions.

Learning outcomes:

At the end of this unit, the students will be able to

- Explain the synthesis and characterization methods of nano materials. (L-2)
- Explain the importance of green synthesis. (L-2)

Text Books

1. P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, (2014).
2. B.K. Sharma, Engineering Chemistry, Krishna Prakasham, (2014).

References

1. Sashi Chawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, (2003)
2. B.S Murthy and P. Shankar, A Text Book of NanoScience and NanoTechnology, University Press (2013).
3. S.S. Dara, A Textbook of Engineering Chemistry, S.Chand & Co, (2010)
4. V. Raghavan, A Material Science and Engineering, Prentice-Hall India Ltd, (2004).
5. N. Krishna Murthy and Anuradha, A text book of Engineering Chemistry, Murthy Publications (2014).
6. K. Sesha Maheshwaramma and Mridula Chugh, Engineering Chemistry, Pearson India Edn services, (2016).

S. No.	Course code	Course Title	Category	L	T	P	Credits
4	R20CSS-ES1101	Computer Programming in C	ES	3	0	0	3

Course Objectives:
The objectives of this course is to acquire knowledge on the
- To impart adequate knowledge on the need of programming languages and problem-solving techniques and develop programming skills.
- To enable effective usage of Control Structures and Implement different operations on   arrays.
- To demonstrate the use of Strings and Functions.
- To impart the knowledge of pointers and understand the principles of dynamic memory allocation.
- To understand structures and unions and illustrate the file concepts and its operations.
- To impart the Knowledge Searching and Sorting Techniques.

Course Outcomes:
    At the end of the Course, Student should be able to:
1. Illustrate the Fundamental concepts of Computers and basics of computer programming.
2. Use Control Structures and Arrays in solving complex problems.
3. Develop modular program aspects and Strings fundamentals.
4. Demonstrate the ideas of pointers usage.
5. Solve real world problems using the concept of Structures, Unions and File operations.

UNIT-I

Introduction to Computers , Algorithm and Flowchart design :
Introduction-Computer Hardware, Bits and Bytes, Components, types of languages.
Algorithm- Definition , Characteristics, Steps to develop ,examples**.**
Flow chart-Definition, symbols, Input/Output, Assignment, conditional if, repetition, function and sub charts. Example problems.
Learning outcomes: Student should be able to
1. Acquire the knowledge on basic computer components, algorithms and flowcharts(L2)
2. Understand the structure of algorithm and flowchart(L2)
3. Develop basic flowcharts and algorithms for performing Input, Output and   Computations (L3)
4. Solve numerical problems using Raptor (L3)

UNIT-II

Introduction to C Programming: Introduction, Structure of a C Program. Comments, Keywords, Identifiers, Data Types, Variables, Constants, Input/output Statements. Operators, Type Conversion.
Control Flow, Relational Expressions: Conditional Branching Statements: if, if-else, if-else—if, switch. Basic Loop Structures: while, do-while loops, for loop, nested loops, The Break and Continue Statements, goto statement.

UNIT-III

Arrays: Introduction, Operations on Arrays, Arrays as Function Arguments, Two dimensional Arrays, Multi dimensional arrays.
Pointers: Cconcept of a Pointer, Declaring and Initializing Pointer Variables, Pointer Expressions and Address Arithmetic, Null Pointers, Generic Pointers, Pointers as Function Arguments, Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation, Dangling Pointer, Command Line Arguments.

UNIT-IV

Functions: Introduction, Function Declaration, Function Definition, Function Call, Categories of Functions, Passing Parameters to Functions, Scope of Variables, Variable Storage Classes. Recursion.
Strings: String Fundamentals, String Processing with and without Library
Functions, Pointers and Strings.

UNIT-V

Structures, Unions, Bit Fields: Introduction, Nested Structures, Arrays of Structures, Structures and Functions, Self-Referential Structures, Unions, Enumerated Data Type —Enum variables, Using Typedef keyword, Bit Fields.

Text Books

1. How to solve it by Computer, R. G. Dromey, and Pearson Education.

2. Computer Programming. Reema Thareja, Oxford University Press
3. Let us C , Yaswanth Kanetkar, 16th Edition,BPB Publication.

Reference Books

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
2. Programming In C A-Practia1 Approach. Ajay Mittal, Pearson.
3. C Programming — A Problem Solving Approach, Forouzan, Gilberg, Cengage.
4. The C Programming Language, Dennis Richie And Brian Kernighan, Pearson Education.
5. Programming In C, Ashok Kamthane, Second Edition, Pearson Publication.

Web Links

1. http://www.c4learn.com/
2. http://www.geeksforgeeks.org/c/
3. http://nptel.ac.in/courses/122104019/
4. http://www.learn-c.org/
5. https://www.tutorialsyoint.com/cprogramming/

S. No.	Course code	Course Title	Category	L	T	P	Credits
5	R20MEC-ES1102	Engineering Graphics	ES	1	0	4	3

Course Objectives:
- To enhance the communications of the students using engineering drawing.
- To make the student familiar to the drawing practices and convection.
- To familiarize the techniques of constructing polygons curves.
- To introduce the orthographic projections, projections of points, lines and planes.
- To make the students understand as to how the industry communicates technical information.
- To enable the student draft simple engineering components and analyze different views of components.

Course Outcomes:
After completing the course, the student will be able to
1. Apply the basics of Engineering Graphics to construct the polygon, curves and orthographic projections of points. (L3)
2. Draw the orthographic projections of straight lines inclined to both the planes. (L3)
3. Draw the projections of planes in various conditions. (L3)
4. Draw the projections of regular solids, its axis inclined to one of the principle plane. (L3)
5. Develop 3D isometric views from 2D orthographic views and vice versa. (L6)

Unit I

Introduction to Engineering graphics: Principles of Engineering Graphics and their significance-Conventions in drawing-lettering - BIS conventions.
Polygons: Constructing regular polygons by general method.,
Curves: Parabola, Ellipse and Hyperbola by general methods.
Orthographic Projections: Horizontal plane, vertical plane, profile plane, importance of reference lines, projections of points in various quadrants.
Applications:
- Conics are found in architecture, physics, astronomy and navigation, Bridges, buildings
- Parabola - satellite dishes, Eiffel tower, parabolic trajectory of a golf ball Hyperbola shape - cooling towers, Elliptical shape - bridges and arches, elliptical trammel
Learning Outcomes:
- Identify the standards of BIS conventions. (L3)
- Draw Conic sections applied in engineering. (L3)
- Draw the projections of points in various quadrants. (L3)

Unit II

Projections of straight lines, lines parallel either two of the reference planes (HP, VP or PP)
Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces- HT, VT.
Applications:
- Structural plans and elevations, stair casing designs.
Learning Outcomes:
- Draw the projections of lines in various conditions. (L3)
- Construct the traces of a line in various conditions. (L6)

Unit III

Projections of planes: regular planes perpendicular/parallel to one plane and inclined to the other reference plane; inclined to both the reference planes.
Applications: AC ducts and elevations, stair casing designs.
Learning Outcomes:
- Visualize and draw the projections of planes in various conditions. (L3)
- Draw the planes inclined to both the reference planes. (L3)

Unit IV

Projections of Solids: Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the planes.

Applications: Machine components, cooling towers, piping layouts.

Learning Outcomes:

- Draw the different types of solids graphically. (L3)
- To visualize and draw the projections of solids in different conditions.(L3)

Unit V

Isometric projections - construction of isometric scale, isometric projections of simple prisms, pyramids, cone and cylinder.

Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Applications: Structural drawings –industrial components, architectural drawing.

Learning Outcomes:

- Identify the orthographic views and isometric views, able to convert isometric views to orthographic views and orthographic views to isometric views, (L3)

Text Books

1. K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.
3. Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

Reference Books

1. Engineering Graphics, P I Varghese McGraw Hill Education (India) Pvt Ltd,
2. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009
3. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009
4. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000
5. K.C.John, Engineering Graphics, 2/e, PHI, 2013

S. No.	Course code	Course Title	Category	L	T	P	Credits
6	R20BSH-CH1106	Engineering Chemistry Lab	BS	0	0	3	1.5

Course Objectives
- To familiarize the students with the basic concepts of Engineering Chemistry lab.
- To train the students on how to handle the instruments.
- To demonstrate the digital and instrumental methods of analysis.
- To expose the students in practical aspects of the theoretical concepts.

Course Outcomes
1. Prepare polymers and nano materials. (L-4)
2. Explain the functioning of the instruments such as Conductivity meter, pH meter, Viscometer, Cleveland's apparatus. (L-2)
3. Analyze the quality of ground water sample. (L-4)
4. Compare kinematic viscosity, acid number, and flash and fire points of different lubricating oils. (L-2)
5. Identify the safety precautions to carry out the experiments in the laboratory using chemicals. (L-3)

List of Experiments
1. Preparation of urea-formaldehyde resin.
2. Determination of copper in a copper ore.
3. Determination of kinematic viscosity of lubricating oil.
4. Determination of acid number of lubricating oil.
5. Determination of flash and fire points of a fuel.
6. Determination of Hardness of a ground water sample.
7. Determination of strength of an acid by pH metric method
8. Determination of strength of an acid by Conductrometric metric method.

Virtual Labs
9. Preparation of nano materials using sol-gel method.
10. Extraction of graphene from graphite.

Text Books
1. Mendham J, Denney RC, Barnes JD, Thosmas M and Sivasankar B Vogel's Quantitative Chemical Analysis 6/e, Pearson publishers (2000).
2. N.K Bhasin and Sudha Rani Laboratory Manual on Engineering Chemistry 3/e, Dhanpat Rai Publishing Company (2007).

S. No.	Course code	Course Title	Category	L	T	P	Credits
7	R20MEC-ES1103	Engineering Workshop & IT Workshop Lab	ES	0	0	3	1.5

Course Objective:

- Familiarize different wood working operation in carpentry.
- Understand to built different parts with sheet metal.
- Familiarize various fitting operations.
- Understand the smithy and black smithy operations for real world applications.
- Identify different types of electrical house wiring connections.
- Understand the basic components and peripherals of a computer

Course Outcomes: After completion of this lab the student will be able to

1. Apply wood working skills in real world applications. (L3)
2. Build different parts with fitting in engineering applications. (L3)
3. Develop various basic prototypes in black smith & tiny smith applications. (L5)
4. Apply different types of basic electric circuit connections. (L3)
5. Understand the basic components, peripherals and basic operations of a computer. (L3)

List of Experiments (Engineering Workshop)

Carpentry (Any Two)

1	T-Lap Joint
2	Cross Lap Joint
3	Dovetail Joint
4	Mortise and Tennon Joint

Fitting (Any Two)

5	Vee Fit
6	Square Fit
7	Half Round Fit
8	Dovetail Fit

Black Smithy (Any One)

9	Round rod to Square
10	S-Hook
11	Round Rod to Flat Ring
12	Round Rod to Square headed bolt

House Wiring (Any Two)

13	Parallel / Series Connection of three bulbs
14	Stair Case wiring
15	Florescent Lamp Fitting
16	Measurement of Earth Resistance

Tin Smithy (Any Two)

17	Taper Tray
18	Square Box without lid
19	Open Scoop
20	Funnel

List of Experiments (IT Workshop)

1. System Assembling, Disassembling and identification of Parts / Peripherals
2. Operating System Installation-Install Operating Systems like Windows, Linux along with necessary Device Drivers.
3. MS-Office / Open Office
   a) Word - Formatting, Page Borders, Reviewing, Equations, symbols.
   b) Spread Sheet - organize data, usage of formula, graphs, charts.
   c) Power point - features of power point, guidelines for preparing an effective presentation.
   d) Access- creation of database, validate data.

S. No.	Course code	Course Title	Category	L	T	P	Credits
8	R20CSS-ES1103	Computer Programming in C Lab	ES	0	0	3	1.5

Course Objectives:

The objectives of this course is to acquire knowledge on the

- To impart knowledge on basic Linux commands, various Editors, Raptor.
- To make the students understand the concepts of C programming.
- To nurture the students on Control Structures and develop different operations on arrays.
- To make use of String fundamentals and modular programming constructs.
- To implement programs using dynamic memory allocation.
- To explain the concepts of Structure and, Unions.

Course Outcomes:

1. Implement basic programs in C and design flowcharts in Raptor.
2. Use Conditional and Iterative statements to solve real time scenarios in C.
3. Implement the concept of Arrays and Modularity and Strings.
4. Apply the Dynamic Memory Allocation functions using pointers.
5. Develop programs using structures..

List of Experiments

1. Introduction to Algorithms and Flowcharts

1.1) Implement Algorithm Development for Exchange the values of Two numbers.
1.2) Given a set of n student's examination marks (in the range 0-100) make a count of the number of students that passed the examination. A Pass is awarded for all of 50 and above.
1.3) Given a set of n numbers design an algorithm that adds these numbers and returns the resultant sum. Assume N is greater than or equal to zero.

2. Introduction to C Programming

2.1) Basic Linux Commands.
2.2) Exposure to Turbo C, Vi, Emacs, Code Blocks IDE, Dev C++.
2.3) Writing simple programs using printf(), scanf() .

3. Raptor

3.1) Installation and Introduction to Raptor.
3.2) Draw a flow chart to find the Sum of 2 numbers.
3.3) Draw a flow chart to find Simple interest.

4. Basic Math

4.1) Write a C Program to convert Celsius to Fahrenheit and vice versa.
4.2) Write a C Program to find largest of three numbers using ternary operator.
4.3) Write a C Program to Calculate area of a Triangle using Heron's formula.

5. Control Flow- I

5.1) Write a C Program to Find Whether the Given Year is a Leap Year or not.
5.2) Write a C program to find the roots of a Quadratic Equation.
5.3) Write a C Program to make a simple Calculator to Add, Subtract, Multiply or Divide Using Switch...case.

6. Control Flow- II

6.1) Write a C Program to Find Whether the Given Number is Prime number or not.
6.2) Write a C Program to Find Whether the Given Number is Armstrong Number or not.
6.3) Write a C program to print Floyd Triangle.

7. Control Flow- III

7.1) Write a C program to find the sum of individual digits of a positive integer.
7.2) Write a C program to check whether given number is palindrome or not.
7.3) Write a C program to read two numbers, x and n, and then compute the sum of the geometric progression $1+x+x'+x^3 +\ldots\ldots\ldots+x^n$.

8. Arrays

8.1) Write a C program to search an element in the given array (Linear Search).
8.2) Write a C program to perform matrix addition.

8.3) Write a C program to perform matrix multiplication.

9. Pointers
9.1) Write a C Program to Perform Addition. Subtraction, Multiplication and Division of two numbers using Command line arguments.
9.2) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc () function.
9.3) Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc () function.

10. Functions, Array & Pointers
10.1) Write a C Program to demonstrate parameter passing in Functions.
10.2) Write a C Program to find Fibonacci. Factorial of a number with recursion and without recursion.
10.3) Write a C Program to find the sum of given numbers with arrays and pointers.

11. Strings
11.1) Implementation of string manipulation operations with library function:
Copy, concatenate, length, compare
11.2) Implementation of string manipulation operations without library function:
Copy, concatenate, length, compare

12. Structures
12.1) Write a C Program to Store Information of a book Using Structure.
12.2) Write a C Program to Add Two Complex Numbers by Passing Structure to a Function.

13. Application
Creating structures to capture the student's details save them in file in proper record format. search and prints the student details requested by the user.

Note: Draw the flowcharts using Raptor from Experiment 3 to Experiment 6.

Text Books
1. Let us C , Yaswanth Kanetkar, 16th Edition,BPB Publication.
2. How to solve it by Computer, R. G. Dromey, and Pearson Education.
3. Computer Programming. Reema Thareja, Oxford University Press

Reference Books
1. Programming in C A-Practical Approach Ajay Mittal. Pearson Education.
2. The C programming Language, Dennis Richie and Brian Kernighan, Pearson Education.
3. Problem solving using C , K Venugopal,3'd Edition,TMG Publication.

Web Links
1. https://www.hackerrank.com/
2. https://www.codechef.com/
3. https://www.topcoder.com/
4. https://code-cracker.github.io/
5. https://raptor.martincar1is1e.com/
6. httos://npte1.ac.in/courses/106105055/2

S. No.	Course code	Course Title	Category	L	T	P	Credits
9	R20BSH-MC1101	Environmental Science	MC	3	0	0	0

Course Objective:
- To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations.
- Students get awareness on pollution that is caused due to the day to day activities of human life to minimize the environmental degradation.
- To make student get awareness on the social issues, environmental legislation.

Course Outcomes:
Student will be able to
1. Understand about the environment and natural resources.
2. Understands about various attributes of different types of pollution and their impacts on the environment and control methods along with waste management practices.
3. Illustrate about the ecosystem and knows the importance of conservation of biodiversity.
4. Relate the current environmental impacts with the societal problems.
5. Identify the current population explosion and their impacts on the environment.

UNIT – I

Multidisciplinary Nature of Environmental Studies: Definition, Multi disciplinary nature of environmental studies, Scope and Importance, Need for Public Awareness.

Natural Resources : Forest resources – Uses of forest resources, deforestation-causes, consequences, Water resources – Use and over utilization of surface and ground water, Floods, drought, dams – benefits and problems, Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, Food resources:, Effects of modern agriculture, fertilizer-pesticide related problems, water logging, salinity, Energy resources: Renewable and non-renewable resources – Natural resources and associated problems, Land Resources: Land degradation, Soil erosion, Desertification.

Learning Outcomes
Students will be able to
- Relate scientific disciplines as they apply to environmental science, such as ecology, evolutionary biology, hydrology, and human behavior.(L1)
- Explain how water resources should be used.(L2)
- Articulate basic understanding of effects of modern agriculture on environment.(L2)
- Explain why renewable and non-renewable energy resources are important.(L2)
- Get awareness about land degradation, soil erosion & desertification.(L2)

Specific Applications:
- Different conservation methods of different natural resources like aforestation programs, social forestry programs, water conservation practices like rainwater harvesting, soaking pits.

UNIT – II

Environmental Pollution and Solid Waste Management
Environmental Pollution: Definition, Cause, effects and control measures of (a) Air Pollution (b) Water pollution (c) Noise pollution
Solid Waste Management: Causes, effects and control measures of urban and industrial wastes, e-waste management, Role of an individual in prevention of pollution.

Learning Outcomes
Students will be able to
- Define and explain the various causes, effects and control measures of different types of pollution.(L3)
- Characterize solid waste and e-waste management.(L2)

Specific Applications:
- Different treatment methods for different types of pollution- cyclone separator, electrostatic precipitators, waste water treatment, solid waste management, e-waste management.

Ecosystems, Biodiversity, and its Conservation
Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem – Producers, consumers and decomposers, Food chains, food webs, Energy flow in the ecosystem, primary and secondary productivity, ecosystem regulation and development.
Biodiversity And Its Conservation: Definition: levels of biodiversity- genetic, species and ecosystem diversity, Bio-geographical classification of India, Value of biodiversity, India as a mega-diversity nation, Hot-spots of biodiversity- Indo Burma, Eastern Himalayas, Western Ghats, Threats to biodiversity-habitat loss, poaching of wildlife, Global environmental issues, Pollution, Man-wildlife conflicts, Conservation of biodiversity- In-situ and Ex-situ conservation of biodiversity.
Learning Outcomes
Students will be able to
- Understand the structure and functions and types of ecosystems.(L2)
- Identify the threats to biodiversity.(L2)
- Compare endangered and endemic species of India.(L2)
Specific Applications:
- Different conservation methods like gene bank, seed bank and botanical garden.

UNIT –IV
Social Issues and the Environment
Social Issues And The Environment: Water conservation- rain water harvesting and watershed management, Resettlement and rehabilitation issues of people, its problems and concerns, case studies-current issue regarding the covid-19.. Climate change- global warming, acid rain, ozone layer depletion, Environmental legislation- Wildlife Protection Act, Forest Conservation Act. Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act.
Learning Outcomes:
Students will be able to
- Articulate the basic structure, functions, and processes of key social systems affecting the environment.(L3)
- Aware of the reasons for various global environmental challenges.(L2)
- Explain the enforcement of Environmental legislation.(L1)
- Remember the various Acts enforced in India and some of their features.(L1)
Specific Applications:
- Water conservation practices like rain water harvesting, soaking pits and modern agricultural methods to minimize the environmental effects.
- Energy conservations methods in houses, industrial sector and commercial sector, apply environmental related laws in environmental issues.

UNIT – V
Human Population and Environmental Management:
Human Population: Population growth, Population explosion, Role of information Technology in Environment and human health.
Environmental management- Significance of EIA ,Environmental Impact Assessment- Methodology, Environmental Impact Statement, Environmental Management Plan, Environmental Audit- process.
Learning Outcomes
Students will be able to
- Understand about the population effects on environment.(L2)
- Be acquainted with role of information technology in environment.(L2)
- Understand about the various environmental management practices. (L2)
Specific Applications:
- Information Technology in different natural calamities and health aspect point of view.
- Industrial and developmental activities.
Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain, Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Text Books

1. Perspectives in Environment Studies, Anubha Kaushik, C P Kaushik, New Age International Publishers, 2014.
2. Text Book of Environmental Studies, K. Raghavan Nambiar, Scitech Publications.
3. Environmental Studies by Palaniswamy – Pearson education
4. Environmental Studies by Dr.S.AzeemUnnisa, Academic Publishing Company

References

1. Textbook of Environmental Science by Deeksha Dave and E.Sai Baba Reddy, Cengage Publications.
2. Text book of Environmental Sciences and Technology by M.Anji Reddy, BS Publication.
3. Comprehensive Environmental Studies by J.P.Sharma, Laxmi publications.
4. Environmental sciences and engineering – J. Glynn Henry and Gary W. Heinke – Prentice hall of India Private limited.
5. A Text Book of Environmental Studies by G.R.Chatwal, Himalaya Publishing House
6. Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Prentice hall of India Private limited.

S. No.	Course code	Course Title	Category	L	T	P	Credits
1	R20BSH-MA1201	Linear Algebra and Multivariable Calculus	BS	3	0	0	3

Course Objectives:
- This course is designed to equip the students with the necessary Mathematical skills and techniques that are essential for an engineering course.
- To enlighten the learners in the concept of Linear Algebra.
- To enlighten the learners in the concept of Multivariable Calculus.

Course Outcomes:
At the end of the course, the student will be able to
1. Apply the matrix algebra techniques to engineering applications. (L3)
2. Apply the concepts of eigen values and eigen vectors to free vibration of a two mass system. (L3)
3. Apply partial differentiation to find maxima and minima of functions of several variables
4. Evaluate the volume and surface area of solids using multiple integrals. (L3)
5. Apply vector differential operators to find potential functions and estimate the work done against a field, circulation and flux using vector integral theorems. (L3)

Unit I

Systems of Linear Equations: Rank, echelon form and normal form of a matrix, PAQ form. homogeneous and non-homogeneous linear equations, Gauss elimination method, Gauss Jordan method.
Application: Finding the current in an electrical circuit.
Learning Outcomes:
At the end of this unit, the student will be able to
- solve the system of linear equations using various matrix techniques. (L3)
- apply the matrix methods to find the current in an electrical circuit at any time. (L3)

Unit II

Eigen values, Eigen vectors and Quadratic forms: Eigen values and Eigen vectors, properties (without proofs), diagonalisation, Cayley-Hamilton theorem (without proof), Quadratic forms, reduction to canonical form by orthogonal and linear transformation, rank, index, signature and nature of the quadratic forms.
Application: Free vibration of two mass systems.
Learning Outcomes:
At the end of this unit, the student will be able to
- find the eigen values and eigen vectors of the given matrix.(L2)
- find the inverse and powers of the matrix using Cayley- Hamilton theorem.(L2)
- identify special properties of a quadratic form(or corresponding matrix). (L3)
- Apply the concepts of eigen values and eigen vectors to free vibration of a two mass system. (L3)

Unit III

Partial Differentiation: Partial derivatives, total derivative, chain rule, Taylor's series and Maclaurin's series of functions of two variables, change of variables, Jacobian, functional dependence.
Applications: Tangent planes and Normal lines, Maxima and Minima of functions with and without constraints, method of Lagrange's multipliers.
Learning Outcomes:
At the end of this unit, the student will be able to
- find partial derivatives of a given function. (L2)
- expand a function of two variables using Taylor's and Maclaurin's series expansion. (L2)
- apply the concept of Jacobian to test whether the given functions are functionally dependent or not. (L3)
- find the Jacobian matrix for given functions. (L2)
- apply the knowledge of partial differentiation to find the maxima and minima of functions of several variables. (L3)
- Use partial differentiation to find tangent planes and normal lines. (L3)

Unit IV

Multiple Integrals: Double integrals, change of variables, change of order of integration, triple integrals, change of variables to spherical polar co-ordinates.

Applications: Area enclosed by plane curves.

Learning Outcomes:

At the end of this unit, the student will be able to

- evaluate double integral of functions of several variables in two dimensions using cartesian and polar coordinates. (L3)
- evaluate triple integrals in cartesian, cylindrical and spherical geometries. (L3)
- apply double integration techniques in evaluating areas enclosed by plane curves. (L3)

Unit V

Vector Calculus (All Theorems without proofs): Scalar and vector point functions, vector operator del, Gradient, Divergence and Curl and vector identities. Line, surface and volume integrals, Green's, Stoke's and Divergence theorems.

Application: Potential surfaces, Work done, flux.

Learning Outcomes:

At the end of this unit, the student will be able to

- apply operator del to scalar and vector point functions. (L3)
- illustrate the physical interpretation of gradient, divergence and curl. (L3)
- find the work done in moving a particle along the path over a force field. (L2)
- evaluate the rates of fluid flow along and across curves. (L3)
- apply Green's, Stokes and Divergence theorem in evaluation of double and triple integrals. (L3)

Textbooks

1. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

References

2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
3. James Stewart, Calculus, 7th Edition, Brooks/Cole Cengage Learning (Chapter 14).
4. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.
5. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018.
6. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
7. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
8. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.

S. No.	Course code	Course Title	Category	L	T	P	Credits
2	R20MEC-ES1203	Material Science and Engineering	ES	3	0	0	3

Course Objectives
- To teach the principles of physical metallurgy, i.e. crystallography of metals, constitution of alloys, phase diagrams and heat treatment of steels.
- Explain the methods to change the properties of materials through heat treatment processes.
- Demonstrate various types of cast irons their properties and applications
- Expose commercially important metals and alloys (both ferrous and non ferrous) with engineering constraints.
- Familiarize properties and applications of ceramics, polymers and composite materials..

Course Outcomes:
After completing the course, the student will be able to
1. Understand the principles of binary phases. (L2)
2. Analyze heat treatment to manufacturing applications. (L3)
3. Select steel and cast irons for a given application. (L3)
4. Explain nonferrous metals and alloys in engineering. (L3)
5. Choose composites for various applications. (L3)

Unit I

Structure of Metals: Crystal Structures: Unit cells, Metallic crystal structures, Imperfection in solids: Point, Line, interstitial and volume defects; dislocation strengthening mechanisms and slip systems.
Application: Selection materials for different applications like aerospace, agriculture etc.
Learning Outcomes:
At the end of this unit, the student will be able to
● explain the importance of material science in engineering.(L1)
● Understand the definitions and terminology of crystallography. (L2)

Unit II

Constitution of Alloys: Necessity of Alloying, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron-Iron-carbide diagram and microstructural aspects of ferrite, cementite, austenite, ledeburite, and cast iron.
Application:
1. Phase Diagrams Can Be Used In Solidification And Casting Problems
2. Design and control of heat treatment procedures for specific alloys
Learning Outcomes:
At the end of this unit the student will be able to
● Distinguish metals and alloys. (L4)
● Make use of the principles of construction of binary phase diagrams. (L3)
● Identify various invariant reactions in binary phase diagrams. (L3)
● Explain the concept of Metallography in studying the microstructures of metals and alloys. (L2)

Unit III

Heat Treatment of Steels: Annealing, tempering, normalizing and spheroidizing, isothermal transformation diagrams for Fe-Fe3C alloys and microstructure development. Continious cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, and vacuum and plasma hardening
Application:
1. Heat treatment of steels can be for changing the physical and mechanical properties like shear strength, toughness and tensile strength of the steel.
2. Heat treated steels can be used in making cutting tools where highly defined edges .
Learning Outcomes:
At the end of this unit the student will be able to
● Understand the importance of steel and iron - iron carbide phase diagram. (L2)

● Explain the influence of heat treatment in modification of properties of steels. (L2)
● Develop a heat treatment cycle based on properties required. (L3)
● Apply the principles of surface hardening methods. (L2)

Unit IV

Steels:
Plain carbon steels, use and limitations of plain carbon steels. AISI& BIS classification of steels. Classification of alloys steels.properties and applications of alloy steels-stainless steels and tool steels.

Cast irons:
Micro structure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast irons.

Application:
1. Plain carbon steels Used for cold headed fasteners and bolts
2. Plain carbon steel also used for making piston rings and hot rolling of steels etc.

Learning Outcomes:
At the end of this unit the student will be able to
● Classify various types of steels, their properties and applications. (L2)
● Identify various types of cast irons, their properties and applications. (L3)
● Compare steels and cast irons and their limitations in applications. (L3)

Unit V

Non-ferrous Metals and Alloys: properties and applications of admiralty brass, $\alpha+\beta$ brasses, brazing brass, aluminium bronzes, tin bronz in copper alloys, properties and applications of aluminium-magnesium, y-alloy(LM14) and aluminium-copper alloys in aluminium alloys. precipitation hardening. properties and applications of α, β and $\alpha+\beta$ in titanium alloys.

Introduction to Ceramics, Polymers and Composites: Classification, properties and applications of ceramics, introduction to polymers and composites.

Applications:
1. Applications of Cu are like making Tubes and pipes, Electrical works, Telecommunications, marine etc.
2. Ceramics are used for making IC engine valve components.

Learning Outcomes:
At the end of this unit the student will be able to
● Explain the importance of non-ferrous metals and alloys in engineering applications. (L2)
● Demonstrate various properties and applications of non-ferrous alloys. (L4)
● Differentiate between hardening of ferrous and non-ferrous alloys. (L4)
● Explain the properties of ceramics and their applications. (L2)

Textbooks(s)

1. V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
2. R.Balasubramaniam, Callister's Material Science and Engineering, 2/e, Wiley India, 2014.

References

1. Y. Lakhtin, Engineering Physical Metallurgy, University Press of the Pacific, 2000.
2. S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
3. L.H.Van Vlack, Elements of Material Science and Engineering, 6/e, Pearson Education, 2008.
4. George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill,

S. No.	Course code	Course Title	Category	L	T	P	Credits
3	R20BSH-PH1203	Engineering Physics	BS	3	0	0	3

Course Objectives:
- To impart knowledge in basic concepts of wave optics, acoustics & Ultrasonics; Crystallography and Modern Engineering Materials
- Familiarize concepts of acoustics & Ultrasonics; Crystallography and Modern Engineering Materials

Course Outcomes:
After the completion of this course the student can able to
1. Interpret the interaction of optic energy with matter on the basis of interference & polarization (L2)
2. Explain the various types of crystal systems (L2)
3. Apply the principles of Lasers and Acoustics to mechanical systems(L2)
4. Describe the properties and applications of Ultrasonics (L3).
5. Identify the fundamentals of modern engineering materials(L2)

Unit I:

Wave optics:
Interference: Principle of superposition of waves- interference of light- Conditions for sustained interference- interference in thin films by Reflection-Newton's Rings- Determination of wavelength; **Applications:** Interference Filters and Testing of flatness of the surfaces
Polarization
Polarization by reflection, refraction and double refraction -Nicol Prism-Half Wave and Quarter Wave Plates; **Applications**: Glare reduction due to sunglasses
. **Learning Outcomes**
After the completion of this chapter the student can able to
- Outline the conditions for sustained interference(L2)
- Identify the Engineering applications of interference (L2)
- Illustrate the concept of polarization and its applications (L2)

Unit II

Crystallography: Space Lattice-Basis set- Unit Cell-Lattice Parameters- Bravis Lattice- Crystal systems-packing fraction of simple Cubic-Body Centered cubic–Face Centered cubic lattice- Bragg's law; **Applications**: Determination of crystal structure by X-ray diffraction powdered method.
Learning Outcomes
After the completion of this chapter the student can able to
- Explain the various types of crystal systems(L2)
- Draw the structures of simple cubic, Body Centered cubic and FC cubic lattice(L3)

Unit III

Lasers and Acoustics: Characteristics- Spontaneous and Stimulated Emissions- Pumping and Population Inversion-Ruby Laser-He-Ne-Laser; **Applications:** LINAR, Laser Welding, cutting and drilling.
Acoustics
Classification of sound – Absorption Coefficient and its determination, Reverberation, Reverberation time- Sabine's Formula for Reverberation Time-Factors affecting acoustics of buildings and their remedies; **Applications:** Noise control and construction of acoustically good hall.
Learning Outcomes
After the completion of this chapter the student can able to
- Construct three level and four level laser systems(L3)
- Identify the requirements of acoustically good hall(L2)
- Derive the Sabine's formula for reverberation time(L3)
- Understand the construction of acoustically free hall (L2)

Unit IV

Ultrasonics: Detection of ultrasonic waves-Kundt's tube method, Properties of Ultrasonic Waves, Determination of wavelength and velocity of Ultrasonic waves by Acoustic Grating - Production of

Ultrasonic by Piezoelectric methods- Non Destructive testing through pulse echo system **Applications:** Medical Applications- Study of movement of internal organs by Sonogram, measurement of depth of sea by Echo sounder measurement of elastic constant in liquid

Learning outcomes:

After the completion of this chapter the student can able to

- Demonstrate the Production of Ultrasonics by magnetostriction & piezoelectric experiments(L3)
- Detect Ultrasonics and their Properties(L3)
- Analyze the movement of internal organs of human body by Sonogram (NDT)(L4)
- Estimate the depth of the ocean Ultrasonic echo sounder (3).

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Unit V

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Modern Engineering Materials: Introduction- metallic glasses and types of metallic glasses, preparation of metallic glasses by sputtering technique, mechanical properties of metallic glasses, applications of metallic glasses as soft magnetic materials, Bio Material as a composite material, conditions required for biomaterial, Metallic bio materials.

Learning Outcomes

After the completion of this chapter the student can able to

- Describe the properties and applications of metallic glasses (L2)
- Apply the composite materials as biomaterials (L3)

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Text Books

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1. M.N. Avadhanulu, P.G. Kshrisagar "A Text book of Engineering Physics" –S.Chand Publications, 2017
2. H.K. Malik &A.K. Singh "Engineering Physics", - McGraw Hill Publishing Company Ltd, 2018
3. Ch. Srinivas, Ch. SeshuBabu, "Engineering Physics", Cengage Learning
4. Gaur R.K and Gupta S.L., "Engineering Physics" –Dhanpat Rai Publishers, 2012

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Reference Text Books

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1. M.K.Varma "Introduction to Mechanics" –Universities Press-2015
2. D.K. Bhattacharya and A. Bhaskaran, "Engineering Physics" –Oxford Publications -2015
3. Sanjay D Jain, Girish G Shastra Buddi, "Engineering Physics" –University Press

S. No.	Course code	Course Title	Category	L	T	P	Credits
4	R20MEC-ES1202	Engineering Mechanics	ES	3	0	0	3

COURSE OBJECTIVES:
- To explain the effect of forces on the body.
- To teach the work done by the body.
- To teach the centroid, centre of gravity & moment of inertia of composite sections.
- To analyze the parameters like velocity, displacement &acceleration of dynamic body.
- To teach the analysis of motion of the body with (or) without application of force.

COURSE OUTCOMES:
1. Find the resultant for any number of forces in mechanical system**. (RBT Level 4: Analyze)**
2. Apply equilibrium conditions on different force systems with or without application of friction. **(RBT Level 3: Apply)**
3. Determine centroid, centre of gravity, area moment of inertia and mass moment of inertia of simple and composite sections. **(RBT Level 3: Apply)**
4. Determine the displacement, velocity &acceleration relations in dynamic systems. (**RBT Level 3: Apply)**
5. Analyze the motion of the bodies with (or) without the application of force. **(RBT Level : 3. Apply & Level 4: Analyze)**

UNIT – I

Introduction to Engineering Mechanics: Basic Concepts, Classification of Engineering Mechanics, laws of mechanics- Newton's First law, Newton's Second law, Newton's Third law, Law of Universal gravitation, parallelogram law of forces, law of transmissibility.

Systems of Forces: Composition and resolution of forces, types of force systems - concurrent and concurrent coplanar forces, resultant of coplanar force systems couple, moment of a force, Varignon's theorem.

Application: design of bearings.

Learning outcomes:
At the end of the unit, student will be able to
- Resolve the forces in mechanical systems (L2)
- Identify the moments and forces (L3)

UNIT II

Equilibrium of Systems of Forces: Analytical method - Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Lami's Theorem, Graphical method - Equilibrium of coplanar forces, Converse of the law of Triangle of forces, converse of the law of polygon of forces condition of equilibrium.

Friction: Introduction**,** limiting friction and impending motion, coulomb's laws of dry Friction, coefficient of friction, cone of friction.

Application: Automobiles tyres.

Learning outcomes:
At the end of the unit, student will be able to
- Draw free body diagram (L3)
- Determine the unknown forces in the given system of forces under equilibrium conditions. (L3)
- Analyze the motion of body under frictional forces. (L4)

UNIT – III

Properties of Surfaces and Volumes: Centroid and centre of gravity, derivation of centroids from first moment of area, centroids of composite sections, centre of gravity of common volumes - cylinder, cone, sphere, theorem of Pappus-guidinus. Moment of Inertia Area moment of inertia of plane and composite shapes, parallel axis theorem, perpendicular axis theorem, polar moment of inertia, mass moment of inertia of common volumes -thin plates, thin rod, cylinder, cone, sphere, rectangular prism, radius of gyration.

Application: analysis on wedges, screws, belts, and bearings.

Learning outcomes:
At the end of the unit, student will be able to
- Identify the centre of gravity of composite sections. (L3)
- Determine the centre of gravity of common solids. (L3)
- Determine moment of inertia for composite volumes. (L3)

UNIT – IV

Kinematics: Introduction to plane motion, equations of motion for rigid bodies, constant and variable acceleration, rectilinear and curvilinear motion, motion under gravity -projectile motion, use of rectangular coordinates, tangential and normal coordinates, radius of curvature, rotation of a rigid body about a fixed axis.

Application: Robotic arms and Automobile Engines.

Learning outcomes:
At the end of the unit, student will be able to
- Write equations of motion for rigid bodies. (L3)
- Find velocity and acceleration in rectilinear and curvilinear motions (L4)
- Trace the path of projectile. (L3)

UNIT – V

Kinetics: Principles of dynamics - Newton's Laws of motion, D'Alembert's principle in rectilinear translation, principle of work and energy. Ideal Systems: Principle of conservation of energy, concept of power, conservation of linear and angular momentum, principle of momentum and impulse, impact - types of impact.

Application: Rocket propulsion systems, missiles etc.

Learning outcomes:
At the end of the unit, student will be able to
- Apply D'Alembert's principle in rectilinear translation. (L3)
- Relate principle of work and energy in dynamic systems. (L3)
- Make use of principle of momentum and impulse to dynamic bodies. (L4)

Text Books
1. N H Dubey, Engineering Mechanics: Statics and Dynamics, McGraw Hill, 2014.
2. S Timoshenko, DH Young, JV Rao, Sukumar Pati, Engineering Mechanics (in SI units), 5/e, McGraw Hill, 2013.
3. S S Bhavikatti, Engineering Mechanics, 4/e, New Age International, 2008.

References
1. Basudeb Bhattacharya., Engineering Mechanics, 2/e, Oxford University Press (India), 2015.
2. Irving Shames, G K M Rao, Engineering Mechanics: Statics and Dynam-ics, 4/e, Pearson, 2009.
3. K L Kumar, Veenu Kumar, Engineering Mechanics, 4/e, Tata McGraw Hill, 2010.

S. No.	Course code	Course Title	Category	L	T	P	Credits
5	R20EEE-ES1204	Basic Electrical & Electronics Engineering	ES	3	0	0	3

Course objectives:
- To familiarizewith the basic DC and AC networks.
- To explain the concepts of electrical machines and their characteristics.
- To identifythe importance of transformers in transmission and distribution of electric power.
- Toimpart knowledge about the characteristics of semiconductor devices.
- To expose basic concepts and applications of Operational Amplifiers.

Course Outcomes: At the end of this course, students areable to
1. Apply concept of KVL/KCL and network theoremsin solving electrical circuits (L3)
2. Understand the principle of operation of different DC Machines(L2)
3. Measure the performance quantities such as losses, efficiency of transformers (L5)
4. Understand the importance and applications of p-n junction diode , Zener diode and rectifiers(L2)
5. Apply different modes of op-amps in different applications (L3)

UNIT I

Basic laws and Theorems: Ohms law, Kirchhoff's Laws, Series and Parallel circuits, Types of Elements and Sources, Mesh analysis, Nodal analysis, superposition theorem, Thevenin's and Norton's theorem, with simple examples.

Unit Outcomes: The students are able to
- Apply Ohms and Kirchhoff's Laws (L3)
- Analyze theorems such as superposition, Thevenin's & Norton's theorems. (L4)
- Find the current, voltage and power in a given electrical circuit(L1)

UNIT II

DC Machines: Constructional features, principle of DC generator & motor- emf equation of generator and torque equation of motor-numerical problems-different types and performance characteristics of DC machines, speed control of DC shunt motor, brake test on DC shunt motor, applications of DC machines.

Unit Outcomes: The students are able to
- Understand the constructional features of DC machines. (L2)
- Analyze EMF, torque and performance characteristics of DC machines. (L4)

UNIT III

AC Machines: Constructional details of single phase transformer, principle and types of transformers, EMF equation, open and short circuit tests on a single phase transformer, voltage regulation, losses and efficiency, numerical problems, principle of operation of three phase induction motor.

Unit Outcomes: The students are able to
- Outline the constructional details and principle of single phase transformer. (L2)
- Analyze the efficiency and voltage regulation of a single phase transformer. (L4)

UNIT IV

Semiconductor Devices: p-n Junction diode - basic operating principle, current-voltage characteristics, rectifier circuits (half-wave, full-wave), Zener diode as voltage regulator, introduction to transistors and its characteristics, applications of semiconductor devices.

Unit Outcomes: The students are able to
- Analyze the device structure, operation and characteristics of a p-n junction diode. (L4)
- Apply p-n diode for various applications. (L3)

UNIT V

Operational Amplifier: Ideal op-amp, inverting configuration, closed loop gain, effect of finite open-loop gain, non-inverting configuration, closed loop gain, voltage follower, differential amplifier.

Unit Outcomes: The students are able to
- Explain different modes of operation of op-amps. (L2)
- Make use of op-amp in different applications. (L3)

Textbooks

1. D.P. Kothari, I.J. Nagrath, Basic Electrical and Electronics Engineering, 1stedition, McGraw Hill Education (India) Private Limited, 2017.
2. B.L. Theraja, Fundamentals of Electrical Engineering and Electronics, 1stedition, S. Chand Publishing, New Delhi, 2006.
3. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits 6th edition, Oxford University Press, 2014.

References

1. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson Education, 2011.
2. Dharma Raj Cheruku, B T Krishna, Electronic Devices and Circuits, 2/e, Pearson Education, 2008.
3. R.K. Rajput, Basic Electrical and Electronics Engineering, University Science Press, New Delhi, 2012.

Web Links

1. https://nptel.ac.in/courses/108/105/108105112
2. https://nptel.ac.in/courses/108/108/108108122
3. https://www.electronics-tutorials.ws

S. No.	Course code	Course Title	Category	L	T	P	Credits
6	R20BSH-EN1201	Communicative English Lab	HM	0	0	3	1.5

Course Objectives
- Adopt activity based teaching-learning methods to ensure that learners would be engaged in use of language both in the classroom and laboratory sessions.
- Facilitate active listening to enable inferential learning through expert lectures and talks
- Impart critical reading strategies for comprehension of complex texts
- Provide training and opportunities to develop fluency in English through participation in formal group discussions and presentations using audio-visual aids
- Demonstrate good writing skills for effective paraphrasing, argumentative essays and formal correspondence
- Encourage use of a wide range of grammatical structures and vocabulary in speech and writing

Course Outcomes
1. Acquire Listening skills for answering questions, make formal presentations without graphical elements, prioritize information from reading texts, paraphrase short academic texts and get awareness about plagiarized content and academic ethics.
2. Comprehend academic lectures by taking notes,, make formal presentations on academic topics using PPT slides with relevant graphical elements, distinguish facts from opinions while reading, write formal letters and emails and use a range of vocabulary in formal speech and writing.
3. Participate in group discussions using appropriate language strategies, comprehend complex texts, produce logically coherent argumentative essays and use appropriate vocabulary to express ideas and opinions.
4. Draw inferences and conclusions using prior knowledge and verbal cues, express thoughts and ideas accurately and fluently, develop advanced reading skills for a deeper understanding of texts, prepare a CV with a cover letter to seek internship/ job, and understand the use of passive voice in academic writing.
5. Develop advanced listening skills for an in-depth understanding of academic texts, make presentations collaboratively, understand the structure of Project Reports and use grammatically correct structures with a wide range of vocabulary.

Unit 1

Listening: Listening for presentation strategies and answering questions on the speaker, the audience, and key points. **Speaking:** Formal presentations using PPT slides without graphic elements. **Reading:** Reading for presenting – strategies to select, compile and synthesize information for presentation; reading to recognize the academic style. **Writing:** Paraphrasing; using quotations in writing; using academic style - avoiding colloquial words and phrases. **Grammar and Vocabulary:** Formal/academic words and phrases.

Learning Outcomes
At the end of the module, the learners will be able to
- understand the purpose of a presentation & make note of key points (L2)
- make formal structured presentations on general topics using PPT slides without graphical elements (L3)
- prioritize information from reading texts after selecting relevant and useful points (L3)
- paraphrase short academic texts using suitable strategies and conventions (L3)
- cultivate awareness about plagiarized content and academic ethics (L2)

Unit 2

Listening: Following an argument/ logical flow of thought; answering questions on key concepts after listening to extended passages of spoken academic discourse. **Speaking:** Formal presentations using PPT slides with graphic elements. **Reading:** Understand formal and informal styles; recognize the difference between facts and opinions. **Writing:** Formal letter writing and email writing (enquiry, complaints, seeking permission, seeking internship); structure, conventions and etiquette. **Grammar and Vocabulary:** Phrasal prepositions; phrasal verbs.

Learning Outcomes

At the end of the module, the learners will be able to
- comprehend academic lectures by taking notes to answer questions (L2)
- make formal structured presentations on academic topics using PPT slides with relevant graphical elements (L3)
- distinguish facts from opinions while reading (L2)
- write formal letters and emails (L3)
- use a range of vocabulary informal speech and writing (L2)

Unit 3

Listening: Identifying views and opinions expressed by different speakers while listening to discussions. **Speaking:** Group discussion on general topics; agreeing and disagreeing, using claims and examples/evidence for presenting views, opinions and positions. **Reading:** Identifying claims, evidence, views, opinions and stance/ position. **Writing:** Writing structured persuasive/argumentative essays on topics of general interest using suitable claims, examples and evidence. **Grammar and Vocabulary:** Language for different functions such as stating a point, expressing opinions, agreeing/ disagreeing, adding information to what someone has stated, and asking for clarification.

Learning Outcomes

At the end of the module, the learners will be able to
- follow a discussion (L2)
- participate in group discussions using appropriate conventions and language strategies (L3)
- comprehend complex texts identifying the author's purpose (L2)
- produce logically coherent argumentative essays (L3)
- use appropriate vocabulary to express ideas and opinions (L2)

Unit 4

Listening: Understanding inferences; processing of information using specific context clues from the text. **Speaking:** Group discussion; reaching consensus in group work (academic context). **Reading:** Reading for inferential comprehension. **Writing:** Applying for internship/ job - Writing one's CV/Resume and cover letter. **Grammar and Vocabulary:** Active and passive voice – use of passive verbs in academic writing.

Learning Outcomes

At the end of the module, the learners will be able to
- draw inferences and conclusions using prior knowledge and verbal cues (L3)
- express thoughts and ideas with acceptable accuracy and fluency (L2)
- develop advanced reading skills for a deeper understanding of texts (L3)
- prepare a CV with a cover letter to seek internship/ job (L2)
- understand the use of passive voice in academic writing (L2)

Unit 5

Listening: Understanding inferences - the processing of explicit information presented in the text and implicit information inferable from the text or from previous/background knowledge. **Speaking:** Formal team presentations on academic/ general topics using PPT slides. **Reading for Writing:** Structure and contents of a Project Report; identifying sections in project reports; understanding the purpose of each section; the significance of references. **Grammar and Vocabulary:** Reinforcing learning; editing short texts; correcting common errors in grammar and usage.

Learning Outcomes

At the end of the module, the learners will be able to
- develop advanced listening skills for in-depth understanding of academic texts (L3)
- collaborate with a partner to make presentations (L2)
- understand the structure of Project Reports (L2)
- use grammatically correct structures with a wide range of vocabulary (L3)

Reference Books

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.

4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012. (Student Book, Teacher Resource Book, CD & DVD)

<div align="center">**Sample Web Resources**</div>

Grammar/Listening/Writing

1-language.com

http://www.5minuteenglish.com/

https://www.englishpractice.com/

Grammar/Vocabulary

English Language Learning Online

http://www.bbc.co.uk/learningenglish/

http://www.better-english.com/

http://www.nonstopenglish.com/

https://www.vocabulary.com/

BBC Vocabulary Games

Free Rice Vocabulary Game

Reading

https://www.usingenglish.com/comprehension/

https://www.englishclub.com/reading/short-stories.htm

https://www.english-online.at/

Listening

https://learningenglish.voanews.com/z/3613

http://www.englishmedialab.com/listening.html

Speaking

https://www.talkenglish.com/

BBC Learning English – Pronunciation tips

Merriam-Webster – Perfect pronunciation Exercises

All Skills

https://www.englishclub.com/

http://www.world-english.org/

http://learnenglish.britishcouncil.org/

Online Dictionaries

Cambridge dictionary online

MacMillan dictionary

Oxford learner's dictionaries

<div align="center">**COMMUNICATIVE ENGLISH LAB-II END EXAM PATTERN**</div>

Internal Exam Pattern :

Day to Day Performance (10M)	Record (5M)	Internal Exam(10M)	Final Total (25 M)
In lab Activity Participation and day to day Assessment performance (10)	Completing the exercises in Lab Manual cum Record (5)	Written Exam (5) +Oral (5)`	25(M)

NOTE:
- 10 day to day Assessments based on five modules carry grades which can be scaled to 10 marks.
- Similarly all 2 modules Practice work is graded that can be scaled to 5 marks for the Record
- Written exam is on Listening, Reading & Writing along with Grammar & Vocabulary.
    a) **Listening:**(Note taking/inference meaning/watching Video clips & Listening to Audio Clip)5 marks
    b) **Reading Comprehension:Chapter 13 to 16 in Wings of Fire**(Multiple-Choice/Multiple cloze/right,wrong,doesn't say)-5 Marks
    c) **Writing**:Emails,/Letter writing/CV -10 Marks
    d) **Grammar & Vocabulary**:Common errors in grammar (5M) pg 108-114 from Avenues & Vocabulary **(How to talk About Personality types-pg31-57 (Session** 1-3) from Word power Made Easy (5 M)-10 Mark

Note: The written exam is for 30 marks and the final score will be scaled for 5 marks.
- Oral Examination is on (Group Discussion/Debate/Presentation Skills / Interview technique tasks from AVENUE Lab Manual)

External Exam Pattern
- **Written test: 20 marks**.**(Listening+Reading+Writing+Grammar & Vocabulary)**
  Note: LRWGV Activities are given from Internal exam Specified Syllabi.
- **Oral Exam: 10 marks** (Debate/GD/Oral presentation) **(Speaking)**
- **Viva-Voce by the External Examiner: 20 marks**
  Note: Total marks allotted for the exam is 50

S. No.	Course code	Course Title	Category	L	T	P	Credits
7	R20BSH-PH1205	Engineering Physics Lab	BS	0	0	3	1.5

Course Objectives:
- To impart knowledge in basic concepts of mechanics, acoustics and material properties.
- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge, spectrometers, travelling microscope, laser device, optical fibre, etc.
- To expose the students in practical aspects of the theoretical physics.

Course Outcomes:
1. Apply the working principles of laboratory experiments in optics, mechanics and acoustics. (L3)
2. Compute the required parameter by suitable formula using experimental values in mechanics, optics & acoustic experiments. (L3)
3. Analyze the experimental results through graphical interpretation. (L4)
4. Recognize the required precautions to carry out the experiment and handling the apparatus in the laboratory. (L2)
5. Demonstrate the working principles, procedures and applications. (L3)

List of Experiments
1. Determination of the rigidity modulus of material by Torsional pendulum
2. Verification of the laws of transverse waves using Sonometer.
3. Determination of the wavelength of laser light by normal incidence method
4. Determination of the radius of curvature of Plano-convex lens by Newton's Rings Method.
5. Determination of the energy band gap of a given semi-conductor
6. Determination of the velocity of sound using acoustics of volume resonator
7. Determination of the acceleration due to gravity at a place in the inertial frame of reference using compound pendulum.
8. Preparation of composite material by hand lay-up method.

Virtual Lab Experiments
9. Determination of elastic constants of the Perspex beam using Cornus interference method.
10. Determination of velocity of ultrasonic waves and Young's modulus of various materials by Kundt's tube apparatus.

Reference Books
1. S.BalaSubrahmanian, M.N.Srinivasan "A Textbook of practical physics" by S.Chand publishers,2017
2. Engineering Physics Lab Manual by Dr.Y. Aparna & Dr.K.Venkateswarao (V.G.S.Book links).
3. Physics Practical Manual, Lorven Publication.
4.Laboratory Experiments in College Physics, C.H. Bernard and C.D. Epp, John Wiley and Sons, Inc., New York, 1995.
5. "Engineering physics Lab Manual; by Narendra Kolla, amigobookssales@gmail.com.

Web Source References
1. http://vlab.co.in/ba_labs_all.php?id=8
2. http://va-iitk.vlabs.ac.in/
3. http://vlab.amrita.edu/?sub=1&brch=282
4. http://vlab.amrita.edu/?sub=1&brch=192

S. No.	Course code	Course Title	Category	L	T	P	Credits
8	R20EEE-BS1204	Basic Electrical and Electronics Engineering Lab	ES	0	0	3	1.5

Course objectives:
- To verify Kirchhoff's laws and theorems.
- To plot the characteristics of DC Machines.
- To know the performance of a Transformer.
- To plot the V-I Characteristics of a diode.
- To design inverting and non-inverting amplifierusing PSPICE.

Course outcomes: At the end of this course, students are able to
1. Prove the laws and theorems (L5)
2. Analyze the characteristics of DC Machines (L4)
3. Identify the performance of a Transformer (L3)
4. Analyze the V-I characteristics of diode (L4)
5. DevelopInverting and Non-Inverting Amplifier using PSPICE (L3)

List of Laboratory Experiments:
1. Verification of Kirchhoff's Laws KVL and KCL.
2. Verification of DC Superposition Theorem.
3. Verification of Thevenin's Theorem and Norton's Theorem.
4. OCC and External characteristics of separately excited DC generators.
5. OC and SC Tests on single phase transformer.
6. Brake Test on DC shunt motor.
7. Speed control of a DC Shunt motor.
8. Input and output characteristics of Bipolar junction transistor
9. Current Voltage Characteristics of a p-n Junction Diode.
10. Diode Rectifier Circuits.
11. Voltage Regulation with Zener Diodes.
12. Inverting and Non-inverting Amplifier Design with Op-amps.