ವಿಶ್ವೇಶ್ವರಯ್ಯತಾಂತ್ರಿಕವಿಶ್ವವಿದ್ಯಾಲಯ

ವಿಟಿಯುಅಧಿನಿಯಮ೧೯೯೪ ರಅಡಿಯಲ್ಲಿಕರ್ನಾಟಕಸರ್ಕಾರದಿಂದಸ್ಥಾಪಿತವಾದರಾಜ್ಯವಿಶ್ವವಿದ್ಯಾಲಯ

VISVESVARAYA TECHNOLOGICAL UNIVERSITY

State University of Government of Karnataka Established as per the VTU Act, 1994 "JnanaSangama" Belagavi-590018, Karnataka, India

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REGISTRAR

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REF: VTU/BGM/Aca-Cirs/SA/2023-24/ 3047 DATE: 19 SEP 2023

CIRCULAR

Subject: Updated 2021 schemes' 5th and 6th semester Scheme and Syllabus of ECE program regarding...

Reference:
1. Chairperson BoS in ECE recommendation letter BKIT/PPL/2023-24/529, Dated 25.08.2023
2. Dean Faculty of Engineering's approval dated 07.09.2023
3. The Hon'ble Vice-Chancellors' approval dated 12.09.2023

A few changes have been made to the scheme and curriculum for the 2021 scheme in light of input from a few colleges and the following opinions of members of the Board of Studies of ECE VTU Belagavi in the meeting held on August 24, 2023. The Dean of the Faculty of Engineering and the Honorable Vice Chancellor of VTU Belagavi have given their approval to the same.

The subject **21EC52- Computer Organization & ARM Microcontrollers** has taken the place of the course/subject 21EC52- Object Oriented Programming with Java & Data Structures. **Microwave Theory and Antennas** is a subject that has been moved to the sixth semester with the course code **21EC62**. The fifth semester marks the introduction of the brand-new topic **21EC54, Electromagnetics Waves**. The Ability Enhancement Courses group at the fifth-semester level has undergone some revisions with the addition of the new courses **21EC83-Java Programming** and **21EC584-Data Structure Using C++**.For the benefit of stakeholders, anupdated scheme and syllabus have been posted on the university's website @ **https://vtu.ac.in/en/b-e-scheme-syllabus/#menu05**.

All the principals of affiliated colleges, Constituent College are hereby informed to bring the content of this circular to the notice of all students and staff concerned without fail.

Sd/-
Registrar

To,

1. All the Principals of the Constituent and Affiliated Colleges of Engineering under the ambit of the University

Copy to

1. To the Hon'ble Vice-Chancellor through the secretary to VC for information
2. Dean Faculty of Engineering for information
3. The Chairperson BoS in ECE VTU Belagavi for information
4. The Registrar (Evaluation) for information and needful
5. The Director (I/c) ITI SMU VTU Belagavi for information and make arrangements to upload it on the VTU web portal.
6. Office Copy

19/09/23

REGISTRAR

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
B.E: Electronics & Communication Engineering / B.E: Electronics & Telecommunication Engineering
NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021 – 22)

V Semester

Computer Organization & ARM Microcontrollers			
Course Code	**21EC52**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	(3:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 13 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives: This course will enable students to:

1. Explain the basic organization of a computer system.
2. Demonstrate functioning of different sub systems, such as processor, Input/output, and memory.
3. Describe the architectural features and instructions of 32-bit microcontroller ARM Cortex M3.
4. Apply the knowledge gained for Programming ARM Cortex M3 for different applications.
5. Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.

Teaching-Learning Process (General Instructions)

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

- Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
- Encourage collaborative (Group) Learning in the class.
- Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
- Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
- Give Programming Assignments.

Module-1

Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement.
Text Book 1: Chapter 1 – 1.3, 1.4, 1.6 (1.6.1-1.6.4, 1.6.7), Chapter 2 – 2.2 to 2.10
Input/Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB.
Text Book 1: Chapter 4 – 4.1, 4.2, 4.4, 4.5, 4.6, 4.7

Teaching-Learning Process	Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3

Module-2

Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations.
Text book 1: Chapter 5 – 5.1 to 5.4, 5.5 (5.5.1, 5.5.2), 5.6

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. Basic concepts of pipelining,

Text book 1: Chapter7, Chapter 8 – 8.1

Teaching-Learning Process	Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3

Module-3

ARM Embedded Systems: Introduction, RISC design philosophy, ARM design philosophy, Embedded system hardware – AMBA bus protocol, ARM bus technology, Memory, Peripherals, Embedded system software – Initialization (BOOT) code, Operating System, Applications.
ARM Processor Fundamentals, ARM core dataflow model, registers, current program status register, Pipeline, Exceptions, Interrupts and Vector Table, Core extensions.
Text book 2: Chapter 1, 2

Teaching-Learning Process	Chalk and Talk, YouTube videos **RBT Level:** L1, L2, L3

Module-4

Introduction to the ARM Instruction set: Introduction, Data processing instructions, Load - Store instruction, Software interrupt instructions, Program status register instructions, Loading constants, ARMv5E extensions, Conditional Execution.
Text book 2: Chapter 3

Teaching-Learning Process	Chalk and Talk, Power point presentations, Programming assignments **RBT Level:** L1, L2, L3

Module-5

Introduction to the THUMB instruction set: Introduction, THUMB register usage, ARM – THUMB interworking, Other branch instructions, Data processing instructions, Stack instructions, Software interrupt instructions.
Efficient C Programming: Overview of C Compilers and optimization, Basic C Data types, C looping structures.
Text book 2: Chapter 4, 5

Teaching-Learning Process	Chalk and Talk, Power point presentations, Programming assignments **RBT Level:** L1, L2, L3

PRACTICAL COMPONENT OF IPCC

Conduct the following experiments by writing Assembly Language Program (ALP) using ARM Cortex M3 Registers using an evaluation board/simulator and the required software tool.

Sl.No	Experiments
1	Write an ALP to i) multiply two 16-bit binary numbers. ii) add two 64-bit numbers.
2	Write an ALP to find the sum of first 10 integer numbers.
3	Write an ALP to find factorial of a number.
4	Write an ALP to add an array of 16-bit numbers and store the 32-bit result in internal RAM.
5	Write an ALP to find the square of a number (1 to 10) using look-up table.
6	Write an ALP to find the largest/smallest number in an array of 32 numbers.
7	Write an ALP to arrange a series of 32-bit numbers in ascending/descending order.
8	i) Write an ALP to count the number of ones and zeros in two consecutive memory locations. ii)Write an ALP to Scan a series of 32-bit numbers to find how many are negative.

Demonstration Experiments (For CIE only not for SEE)	
Conduct the following experiments on an ARM CORTEX M3 evaluation board using evaluation version of Embedded 'C' & Keil µvision-4 tool/compiler.	
9	Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
10	Interface a DAC and generate Triangular and Square waveforms.
11	Display the Hex digits 0 to F on a 7-segment LED interface, with a suitable delay in between.
12	Interface a simple Switch and display its status through Relay, Buzzer and LED.

Course Outcomes

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

1. Explain the basic organization of a computer system.
2. Demonstrate functioning of different sub systems, such as processor, Input/output, and memory.
3. Describe the architectural features and instructions of 32-bit microcontroller ARM Cortex M3.
4. Apply the knowledge gained for Programming ARM Cortex M3 for different applications.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component.

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Textbooks

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition, Tata McGraw Hill, 2002. (Listed topics only from Chapters 1, 2, 4, 5, 8).
2. Andrew N Sloss, Dominic System and Chris Wright, "ARM System Developers Guide", Elsevier, Morgan Kaufman publisher, 1st Edition, 2008.

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

Programming Assignments / Mini Projects can be given to improve programming skills

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E: Electronics & Communication Engineering / B.E: Electronics & Telecommunication Engineering NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2021 – 22)

V Semester

ELECTROMAGNETIC WAVES			
Course Code	**21EC54**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	(3:0:0:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory	Total Marks	100
Credits	03	Exam Hours	03

Course objectives: This course will enable students to :

- Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient.
- Understand the applications of Coulomb‘s law and Gauss law to different charge distributions and the applications of Laplace‘s and Poisson‘s Equations to solve real time problems on capacitance of different charge distributions.
- Understand the physical significance of Biot-Savart‘s, Amperes‘s Law and Stokes‘theorem for different current distributions.
- Infer the effects of magnetic forces, materials and inductance.
- Know the physical interpretation of Maxwell‘ equations and applications for Plane waves for their behavior in different media.
- Acquire knowledge of Poynting theorem and its application of power flow.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes criticalthinking
3. Adopt Problem Based Learning (PBL), which fosters students’ analytical skills, develop thinkingskills such as the ability to evaluate, generalize & analyze information rather than simply recall it.
4. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
5. Using videos for demonstration of the fundamental principles to students for better understandingof concepts.

Module-1

Revision of Vector Calculus – **(Text 1: Chapter 1)**

Coulomb’s Law, Electric Field Intensity and Flux density: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Field due to Sheet of charge, Electric flux density, Numerical Problems. **(Text: Chapter 2.1 to 2.5, 3.1)**

Teaching-LearningProcess	Chalk and Talk would be helpful for the quantitative analysis. Videos of the Basicprinciples of the devices would help students to grasp better. **RBT Level:** L1, L2, L3

Module-2

Gauss's law and Divergence: Gauss 'law, Application of Gauss' law to point charge, line charge, Surface charge and volume charge, Point (differential) form of Gauss law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator ▼ and divergence theorem, Numerical Problems (**Text: Chapter 3.2 to 3.7).**

Energy, Potential and Conductors: Energy expended or work done in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Potential gradient, Numerical Problems **(Text: Chapter 4.1 to 4.4 and 4.6).**Current and Current density, Continuity of current. **(Text: Chapter 5.1, 5.2)**

Teaching-Learning Process	Chalk and Talk, PowerPoint Presentation **RBT Level:** L1, L2, L3

Module-3

Poisson's and Laplace's Equations: Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation, Numerical problems on Laplace equation **(Text: Chapter 7.1 to 7.3)**

Steady Magnetic Field: Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magneticflux and magnetic flux density, Basic concepts Scalar and Vector Magnetic Potentials, Numerical problems. (**Text: Chapter 8.1 to 8.6)**

Teaching-LearningProcess	Chalk and talk method, Power point presentation and videos. **RBT Level:** L1, L2, L3

Module-4

Magnetic Forces: Force on a moving charge, differential current elements, Force between differential current elements, Numerical problems **(Text: Chapter 9.1 to 9.3).**

Magnetic Materials: Magnetization and permeability, Magnetic boundary conditions, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance and mutualreactance, Numerical problems **(Text: Chapter 9.6 to 9.7).**

Faraday' law of Electromagnetic Induction –Integral form and Point form, Numerical problems **(Text: Chapter 10.1)**

Teaching-LearningProcess	Chalk and Talk, PowerPoint Presentation **RBT Level:** L1, L2, L3

Module-5

Maxwell's equations Continuity equation, Inconsistency of Ampere's law with continuity equation, displacement current, Conduction current, Derivation of Maxwell's equations in point form, and integral form, Maxwell's equations for different media, Numerical problems **(Text: Chapter 10.2 to 10.4)**

Uniform Plane Wave: Plane wave, Uniform plane wave, Derivation of plane wave equations from Maxwell's equations, Solution of wave equation for perfect dielectric, Relation between E and H, Wave

propagation in free space, Solution of wave equation for sinusoidal excitation, wave propagation in any conducting media (**γ, α, β, η**) and good conductors, Skin effect or Depth of penetration, Poynting's theorem and wave power, Numerical problems. **(Text: Chapter 12.1 to 12.4)**	
Teaching-LearningProcess	Chalk and Talk, PowerPoint Presentation **RBT Level:** L1, L2, L3

Course Outcomes

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

- Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applyingconventional methods and charge in a volume.
- Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem.
- Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different currentconfigurations
- Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.
- Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Text Book:

1. W.H. Hayt and J.A. Buck, —Engineering Electromagnetics‖, 8th Edition, Tata McGraw-Hill, 2014, ISBN-978-93-392-0327-6.

Reference Books:

1. Elements of Electromagnetics – Matthew N.O., Sadiku, Oxford university press, 4th Edn.
2. Electromagnetic Waves and Radiating systems – E. C. Jordan and K.G. Balman, PHI, 2nd Edn.
3. Electromagnetics- Joseph Edminister, Schaum Outline Series, McGraw Hill.
4. N. NarayanaRao, —Fundamentals of Electromagnetics for Engineering‖, Pearson

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/108/104/108104087/

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

Quizzes, Seminars

JAVA Programming			
Course Code	21EC583	CIE Marks	50
Teaching Hours/Week	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	3

Course Objectives

- To introduce Java JDK environment to create, debug and run simple Java programs.
- Use java programming to develop programs for solving real-world problems.
- To introduce the basics of object-oriented programming concepts.

Sl. No.	Experiments
01	a) Write a program to accept two integer numbers from the standard input and perform the following arithmetic operations: addition, subtraction and multiplication. b) Write a program to calculate simple and compound interest. c) Write a Program to Swap Two Numbers with and without temporary variables.
02	a) Write a program that prints all real solutions to the quadratic equation ax2+bx+c=0. Read in a, b, c and use the quadratic formula. b) Write a Program to display All Prime Numbers from 1 to N. c) Write a Program for factorial of a number.
03	a) Write a program to search a given element in the array using linear and binary search techniques b) Write a program to sort the elements in ascending and descending order using bubble sort c) Write a program to find the largest and smallest element in an array.
04	Given two matrices A and B, write a program to: a) Add the matrices b) Multiply the matrices c) Find the determinant of a matrix
05	Write a program to perform the following: a) Reverse a string b) Check for palindrome c) Compare two strings
06	Create a Java class called Student with the following details as variables within it. USNName Branch and Phone Write a Java program to create n Student objects and print the USN, Name, Branch, and Phone of these objects with suitable headings.

07	Write a Java program to create a class known as "BankAccount" with methods called deposit() and withdraw(). Create a subclass called SBAccount that overrides the withdraw() method to prevent withdrawals if the account balance falls below one hundred.
08	Write a JAVA program demonstrating Method overloading and Constructor overloading
09	Design a super class called Staff with details as StaffId, Name, Phone, Salary. Extend this class by writing three subclasses namely Teaching (domain, publications), Technical (skills), and Contract (period). Write a Java program to read and display at least 3 staff objects of all three categories.
10	a) Write a JAVA program to read two integers a and b. Compute a/b and print, when b is not zero. Raise an exception when b is equal to zero. Also demonstrate working of ArrayIndexOutOfBound-Exception b) Write a Java program to create a method that takes an integer as a parameter and throws an exception if the number is odd
11	Write a Java program to create an abstract class BankAccount with abstract methods deposit() and withdraw(). Create subclasses: SavingsAccount and CurrentAccount that extend the BankAccount class and implement the respective methods to handle deposits and withdrawals for each account type.
12	Create two packages P1 and P2. In package P1, create class A, class B inherited from A, class C . In package P2, create class D inherited from class A in package P1 and class E. Demonstrate working of access modifiers (private, public, protected, default) in all these classes using JAVA

Course Outcomes

- Use Eclipse/NetBeans IDE to design, develop, debug Java Projects.
- Analyze the necessity for Object Oriented Programming paradigm over structured programming and become familiar with the fundamental concepts in OOP.
- Demonstrate the ability to design and develop java programs, analyze, and interpret object-oriented data and document results.
- Apply the concepts of multiprogramming, exception/event handling, abstraction to develop robustPrograms.

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is 50 Marks. The split-up of CIE marks for record/ journal and test

are in the ratio 60:40.

- Each experiment to be evaluated for conduction with observation sheet and record write-up.
- Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed bythe faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-upwill be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book.
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks. SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure andresult in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners). Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. The duration of SEE is 03 hours Rubrics suggested in Annexure-II of Regulation book.

Suggested Learning Resources:

1. E. Balagurusamy, Programming with Java, Graw Hill, 6th Edition, 2019
2. Herbert Schildt, C: Java the Complete Reference, McGraw Hill, 11th Edition, 2020

Data Structures using C++			
Course Code	21EC584	CIE Marks	50
Teaching Hours/Week	0:0:2:0	SEE Marks	50
Credits	1	Exam Hours	3

Course Objectives

- To write and execute programs in C++ to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphsand search trees.
- To learn to write C++programs to implement various sorting and searching algorithms

Sl. No.	Experiments
01	Write a C++ program that uses functions to perform the following: a) Create a singly linked list of integers. b) Delete a given integer from the above linked list. c) Display the contents of the above list after deletion.
02	Write a template-based C++ program that uses functions to perform the following: a) Create a doubly linked list of elements. b) Delete a given element from the above doubly linked list. c) Display the contents of the above list after deletion.
03	Write a C++ program that uses stack operations to convert a given infix expression into its postfix equivalent, Implement the stack using an array.
04	Write a C++ program to implement a double ended queue ADT using an array, using a doubly linked list.
05	Write a C++ program that uses function templates to perform the following: a) Search for a key element in a list of elements using linear search. b) Search for a key element in a list of sorted elements using binary search.
06	Write a C++ program that implements Insertion sort algorithm to arrange a list of integers in ascending order.
07	Write a template-based C++ program that implements selection sort algorithm to arrange a list of elements in descending order.
08	Write a template-based C++ program that implements Quick sort algorithm to arrange a list of elements in ascending order.
09	Write a C++ program that implements Heap sort algorithm for sorting a list of integers in ascending order.
10	Write a C++ program that implements Radix sort algorithm for sorting a list of integers in ascending order.

11	Write a C++ program that uses functions to perform the following: a) Create a binary search tree of integers. b) Traverse the above Binary search tree non recursively in Inorder.
12	Write a C++ program that uses functions to perform the following: a) Create a binary search tree of integers. b) Search for an integer key in the above binary search tree non recursively. c) Search for an integer key in the above binary search tree recursively.

Course Outcomes: At the end of the course the students will be able to:

- identify the appropriate data structures and algorithms for solving real world problems.
- implement various kinds of searching and sorting techniques.
- implement data structures such as stacks, queues and Search treesto solve various computing problems.

Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is 50 Marks. The split-up of CIE marks for record/ journal and test are in the ratio 60:40.

- Each experiment to be evaluated for conduction with observation sheet and record write-up.
- Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book.
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks. SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners). Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. The duration of SEE is 03 hours Rubrics suggested in Annexure-II of Regulation book.

Suggested Learning Resources:

1. Data Structures using C++, D. S. Malik, 2nd edition, Cengage learning.
2. Data structures, Algorithms, and applications in C++, Sartaj Sahni, Universities Press, 2nd Edition, 2005.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
B.E: Electronics & Communication Engineering / B.E: Electronics & Telecommunication Engineering
NEP, Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021 – 22)

VI Semester

Microwave Theory and Antennas			
Course Code	**21EC62**	CIE Marks	50
Teaching Hours/Week (L: T: P: S)	(3:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 12 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives: This course will enable students to :

1. Describe the microwave properties and its transmission media.
2. Describe the microwave devices for several applications.
3. Understand the basic concepts of antenna theory.
4. Identify antenna types for specific applications.

Teaching-Learning Process (General Instructions)

The sample strategies, which the teacher can use to accelerate the attainment of the various course outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
3. Adopt Problem Based Learning (PBL), which fosters students' analytical skills, develop thinking skills such as the ability to evaluate, generalize & analyze information rather than simply recall it.
4. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
5. Using videos for demonstration of the fundamental principles to students for better understanding of concepts.
6. Demonstration of microwave devices and Antennas in the lab environment where students can study them in real time.

Module-1

Microwave Sources: Introduction, Gunn Diode (Text 2: 7.1,7.1.1,7.1.2)

Microwave transmission lines: Microwave frequencies, Microwave devices, Microwave systems. Transmission line equations and solutions, Reflection Coefficient and Transmission Coefficient. Standing wave and standing wave ratio. Smith chart, Single stub matching.

Text 2: 0.1, 0.2, 0.3, 3.1, 3.2, 3.3, 3.5, 3.6 (except double stub matching)

Teaching-Learning Process	Chalk and Talk would be helpful for the quantitative analysis. Videos of the Basic principles of the devices would help students to grasp better. **RBT Level:** L1, L2, L3

Module-2

A Closer Look at Methods and classes: Overloading methods, Using objects as parameters, Returning **Microwave Network Theory**: Introduction, S matrix representation of multi-port networks (Text 1: 6.1, 6.3, 6.3.1, 6.3.2)

Microwave passive devices: Coaxial connectors and Adapters, Attenuators, Phase shifters, waveguide Tees, Magic Tee, Circulator, Isolator. (Text 1: 6.4.2, 6.4.14, 6.4.15, 6.4.16, 6.4.17 A, B)

Teaching-Learning	Chalk and Talk, PowerPoint Presentation

Process	**RBT Level:** L1, L2, L3
Module-3	
Strip Lines: Introduction, Microstrip lines, Parallel Strip lines (Text 2: 11.1,11.2) **Antenna Basics**: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity,Beam efficiency, Directivity and Gain, Antenna Aperture Effective height, Bandwidth, Radio communication Link, Antenna Field Zones (Text 3: 2.1-2.7, 2.9-2.11, 2.13).	
Teaching-Learning Process	Chalk and talk method, Power point presentation and videos. **RBT Level:** L1, L2, L3
Module-4	
Point sources and arrays: Introduction, Point Sources, Power patterns, Power theorem, Radiation Intensity, Arrays of 2 isotropic point sources, Pattern multiplication, Linear arrays of n Isotropic sources of equal amplitude and Spacing. (Text 3: 5.1-5.6, 5.9, 5.13) **Electric Dipole**: Introduction, Short Electric dipole, Fields of a short dipole. Radiation resistance of a short dipole. Thin linear antenna (field analysis). (Text 3: 6.1-6.5)	
Teaching-Learning Process	Chalk and Talk, PowerPoint Presentation **RBT Level:** L1, L2, L3
Module-5	
Loop and Horn antenna: Introduction: Small loop, Comparison of far fields of small loop and Short dipole. Radiation resistance of small loop, Horn Antennas, Rectangular antennas. (Text 3: 7.1,7.2, 7.4, 7.6, 7.7, 7.8, 7.19, 7.20) **Antenna Types**: The Helix geometry, Helix modes, Practical design consideration for mono-filar axial mode Helical Antenna, Yagi Uda array, Parabolic Reflector (Text 3: 8.3, 8.4, 8.5, 8.8, 9.5)	
Teaching-Learning Process	Chalk and Talk, PowerPoint Presentation **RBT Level:** L1, L2, L3

PRACTICAL COMPONENT OF IPCC	
Sl.No	**Experiments**
1	Study of characteristics of Magic Tee.
2	Coupling and Isolation characteristics of microstrip directional coupler.
3	Determination of power division of microstrip power divider.
4	Determination of resonance characteristics of microstrip ring resonator and computation of dielectric constant of the substrate.
5	Measurement of frequency, guide wavelength, power and attenuation in a microwave Test bench.
6	Study of characteristics of E plane Tee / H plane Tee.
7	To measure unknown impedance using Smith chart through test bench setup.
8	Measurement of VSWR and reflection coefficient and attenuation in a microwave test bench setup.
9	Obtain the radiation pattern of a Yagi-Uda Antenna array and calculate its directivity.
10	Calculate the aperture of a Dipole Antenna.
11	Obtain the near and far fields of a given antenna and compare the fields.
12	Obtain the bandwidth of a given Antenna.

Course Outcomes

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

1. Describe the use and advantages of microwave transmission
2. Analyze various parameters related to transmission lines.
3. Identify microwave devices for several applications.
4. Analyze various antenna parameters and their significance in building the RF system.
5. Identify various antenna configurations for suitable applications.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks.

Marks of all experiments' write-ups are added and scaled down to 15 marks.

- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component.

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Text Books:

1. Microwave Engineering -Annapurna Das, Sisir K Das, TMH Publication, 2nd Edition, 2010.
2. Microwave Devices and Circuits – Samuel Y Liao, Pearson Education.
3. Antennas and Wave Propagation -John D Krauss, Ronald J Marhefka, Ahmad S Khan, 4th Edition, McGraw Hill Education, 2013.

Reference Books:

1. Microwave Engineering -David M Pozar, John Wiley India Pvt Ltd., Pvt Ltd., 3rd edition, 2008.
2. Microwave Engineering-Sushrut Das, Oxford Higher Education, 2nd Edn, 2015.
3. Antennas and Wave Propagation- Harish and Sachidananda, Oxford University Press, 2007.

Web links and Video Lectures (e-Resources):

- https://www.tutorialspoint.com/antenna_theory/antenna_theory_horn.html
- http://www.antenna-theory.com/antennas/smallLoop.php

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

Quizzes, Seminars