॥ सा विद्या या विमुक्तये ॥

# स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड - ४३१ ६०६ (महाराष्ट्र राज्य) भारत

# SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with'B++' grade

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

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## Academic-1 (BOS) Section

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**विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरण २०२० च्या अनुषंगाने शैक्षणिक वर्ष २०२३–२४ पासून संलग्न महाविद्यालये व विद्यापीठ संकुलांत पदव्युत्तर पदवी प्रथम वर्ष आणि विद्यापीठ संकुले व न्यू मॉडेल डिग्री कॉलेज मध्ये पदवी प्रथमवर्ष अभ्यासक्रम लागू करण्याबाबत.**

# प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, शासन निर्णय क्र. एनईपी २०२०/प. क्र. ०९/विशि–३/शिकाना, दिनांक २० एप्रिल २०२३ व शासन पत्र. क्र एनईपी २०२०/प. क्र. ०९/विशि–३, दिनांक १६ जून २०२३ अन्वये सूचित केल्यानुसार राष्ट्रीय शैक्षणिक धोरण २०२०च्या अनुषंगाने दिलेल्या आराखडया नुसार दिनांक १६ जून २०२३ रोजी संपन्न झालेल्या मा. विद्यापरिषदेच्या बैठकीत ऐनवेळचा विषय क्र. ०५/५६–२०२३ अन्वये मान्यता दिल्यानुसार प्रस्तुत विद्यापीठाच्या विज्ञान व तंत्रज्ञान विद्याशाखा अंतर्गत खालील पदव्युत्तर पदवी अभ्यासक्रम (AICTE, PCL, BCI, CoA, NCTE इ. सारख्या नियमक संस्थाची मान्यता आवश्यक असलेले अभ्यासक्रम वगळून) संलग्न महाविद्यालये, विद्यापीठ परिसर व उपपरिसर संकुलांमध्ये आणि पदवी प्रथम वर्ष अभ्यासक्रम विद्यापीठ परिसर व उपपरिसर संकुले व विद्यापीठ संचलित न्यू मॉडेल डिग्री कॉलेज, हिंगोली येथे शैक्षणिक वर्ष २०२३–२४ पासून लागू करण्यात येत आहे.

1) M.Sc. Biotechnology (1st Year) - Campus School
2) M.Sc. Biotechnology (1st Year) – Affiliated colleges
3) B.Sc. Biotechnology (1st Year) – New Model Degree College, Hingoli
4) M.Sc. Botany (1st Year) - Campus School
5) M.Sc. Botany (1st Year) – Affiliated colleges
6) M.Sc. Herbal Medicine (1st Year) - Affiliated colleges
7) M.Sc. Chemistry (1st Year) - Campus School
8) M.Sc. Chemistry (1st Year) - Affiliated colleges
9) M.Sc. Computer Science / Computer Network / Computer Applications (1st Year) University campus, sub campus Latur
10) M.Sc. System Administration & Networking (1st Year) – Affiliated colleges
11) M.Sc. Computer Management (1st Year) – Affiliated Colleges
12) M.Sc. Computer Science (1st Year) – Affiliated Colleges
13) M.Sc. Dairy Science (1st Year) - Affiliated colleges
14) M.Sc. Electronic (1st Year) - Affiliated colleges
15) M.Sc. Geology (1st Year) – University Campus
16) M.Sc. Geography (1st Year) – University Campus
17) M.Sc. Applied Mathematics (1st Year) – Affiliated Colleges
18) M.Sc. Mathematics (1st Year) – Affiliated Colleges
19) M.Sc. Microbiology (1st Year) - University Campus
20) M.Sc. Microbiology (1st Year) – Affiliated colleges

21) M.Sc. Physics (1st Year) - University Campus
22) M.Sc. Physics (1st Year) – Affiliated Colleges
23) M.Sc. Statistics (1st Year) - University Campus
24) M.Sc. Statistics (1st Year) – Affiliated colleges
25) M.Sc. Biochemistry (1st Year) – Affiliated Colleges
26) M.Sc. Zoology (1st Year) – Affiliated Colleges

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.:शै–१/एनइपी२०२०/S&T/अक/२०२३–२४/ 130

सहा.कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

**दिनांक :** ३०.०६.२०२३.

प्रत : १) मा. प्राचार्य, सर्व संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
२) मा. संचालक, सर्व संकुले परिसर व उपपरिसर, प्रस्तुत विद्यापीठ
३) मा. प्राचार्य, न्यु मॉडेल डिग्री कॉलेज हिंगोली.
४) मा. समन्यवक, कै. श्री उत्तमराव राठोड आदिवासी विकास व संशोधन केंद्र, किनवट.

प्रत माहितीस्तव :
१) मा. कुलगुरू महोदयांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. कुलसचिव, प्रस्तुत विद्यापीठ.
३) मा. सर्व आधिष्ठाता, प्रस्तुत विद्यापीठ.
४) सर्व प्रशासकीय विभाग प्रमुख साहाय्यक, प्रस्तुत विद्यापीठ.
५) सिस्टीम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

# SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED - 431 606

# (R-2023)


## TWO YEAR MASTERS PROGRAMME IN SCIENCE

Subject - **Electronics**

***(Affiliated Colleges)***

**Under the Faculty of**
***Science and Technology***

**Effective from Academic year 2023 – 2024**
**(As per NEP-2020)**

## ***From the Desk of the Dean, Faculty of Science and Technology***

Swami Ramanand Teerth Marathwada University, Nanded, enduring to its vision statement "***Enlightened Student: A Source of Immense Power",*** is trying hard consistently to enrich the quality of science education in its jurisdiction by implementing several quality initiatives. Revision and updating curriculum to meet the standard of the courses at national and international level, implementing innovative methods of teaching-learning, improvisation in the examination and evaluation processes are some of the important measures that enabled the University to achieve the **3Es, the** ***equity, the efficiency and the excellence*** in higher education of this region. To overcome the difficulty of comparing the performances of the graduating students and also to provide mobility to them to join other institutions the University has adopted the *cumulative grade point average* (CGPA) system in the year 2014-2015. Further, following the suggestions by the UGC and looking at the better employability, entrepreneurship possibilities and to enhance the latent skills of the stakeholders the University has adopted the *Choice Based Credit System* (CBCS) in the year 2018-2019 at graduate and post-graduate level. This provided flexibility to the students to choose courses of their own interests. To encourage the students to opt the world-class courses offered on the online platforms like, NPTEL, SWAYM, and other MOOCS platforms the University has implemented the credit transfer policy approved by its Academic Council and also has made a provision of reimbursing registration fees of the successful students completing such courses.

SRTM University has been producing a good number of high caliber graduates; however, it is necessary to ensure that our aspiring students are able to pursue the right education. Like the engineering students, the youngsters pursuing science education need to be equipped and trained as per the requirements of the R&D institutes and industries. This would become possible only when the students undergo studies with an updated and evolving curriculum to match global scenario.

Higher education is a dynamic process and in the present era the stakeholders need to be educated and trained in view of the self-employment and self-sustaining skills like start-ups. Revision of the curriculum alone is not the measure for bringing reforms in the higher education, but invite several other initiatives. Establishing industry-institute linkages and initiating internship, on job training for the graduates in reputed industries are some of the important steps that the University would like to take in the coming time. As a result, revision of the curriculum was the need of the hour and such an opportunity was provided by the New Education Policy 2020. National Education Policy 2020 (NEP 2020) aims at equipping students with knowledge, skills, values, leadership qualities and initiates them for lifelong learning. As a result the students will acquire expertise in specialized areas of interest, kindle their intellectual curiosity and scientific temper, and create imaginative individuals.

The curriculum given in this document has been developed following the guidelines of NEP-2020 and is crucial as well as challenging due to the reason that it is a transition from general science-based to the discipline-specific-based curriculum. All the recommendations of the ***Sukanu***

***Samiti*** given in the **NEP Curriculum Framework-2023** have been followed, keeping the disciplinary approach with rigor and depth, appropriate to the comprehension level of learners. All the Board of Studies (BoS) under the Faculty of Science and Technology of this university have put in their tremendous efforts in making this curriculum of international standard. They have taken care of maintaining logical sequencing of the subject matter with proper placement of concepts with their linkages for better understanding of the students. We take this opportunity to congratulate the Chairman(s) and all the members of various Boards of Studies for their immense contributions in preparing the revised curriculum for the benefits of the stakeholders in line with the guidelines of the Government of Maharashtra regarding NEP-2020. We also acknowledge the suggestions and contributions of the academic and industry experts of various disciplines.

We are sure that the adoption of the revised curriculum will be advantageous for the students to enhance their skills and employability. Introduction of the mandatory ***On Job Training, Internship*** program for science background students is praise worthy and certainly help the students to imbibe first-hand work experience, team work management. These initiatives will also help the students to inculcate the workmanship spirit and explore the possibilities of setting up of their own enterprises.

**Dr. L. M. Waghmare,** ***Dean,*** *Faculty of Science and Technology*
**Dr. M. K. Patil,** ***Associate Dean,*** *Faculty of Science and Technology*

# Swami Ramanand Teerth Marathwada University, Nanded

## Faculty of Science & Technology

**Credit Framework for Two Year PG Program**

## Subject: Electronics

| Year & Level | Sem. | Major Subject | | RM | OJT / FP | Research Project | Practicals | Credits | Total Credits |
|---|---|---|---|---|---|---|---|---|---|
| | | (DSC) Department Specific Core | (DSE) Department Specific Elective | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 1 | **SELEC401 (4 Cr)** (Semiconductor Devices and Technology) **SELEC402 (4 Cr)** (Embedded System Design) **SELEC403 (4 Cr)** (Measurement & Instrumentation) | **SELEE401 (3 Cr)** (A) Programming in C/C++ **OR** (B) Internet of Things | **SVECR 401** *Research Methodology* **(3 Cr)** | | | **SELEP401 (1Cr)** (Semiconductor Lab) **SELEP402 (1Cr)** (Embedded Lab) **SELEP403 (1Cr)** (instrumentation Lab) **SELEP404 (1Cr)** (C-Prog. Lab) | **22** | **44** |
| | 2 | **SELEC451 (4 Cr)** (Digital System Design) **SELEC452 (4 Cr)** (Fiber Optics Communication) **SELEC453 (4 Cr)** **(**Network Analysis) | **SELEE451(3Cr)** (A) Introduction to JAVA **OR** (B)Digital Image Processing | **---** | **SELEOJ 451 (3 Cr)** | -- | **SELEP451 (1Cr)** (Digital Lab) **SELEP452 (1Cr)** (Fiber optics Lab) **SELEP453 (1Cr)** (Network Lab) **SELEP454 (1Cr)** (Java- Lab) | **22** | |
| **Exit option: Exit Option with PG Diploma *(after 2024-25)*** | | | | | | | | | |
| 2 | 3 | **SELEC501(4Cr)** (Electrodynamics) **SELEC502 (4 Cr)** (Communication Electronics) **SELEC503 (4 Cr)** (Programmable Logic Controller | **SELEE501 (4 Cr)** ***(From same Department / School)*** (A) Analog Circuit Design **OR** (B) Introduction to Web Technologies | -- | | Research Project **SELER551 (4 Cr)** | **SELEP501 (1Cr** (Communication Lab) **SELEE502 (1Cr)** (PLC Lab-) | **22** | **44** |
| | 4 | **SELEC551 (4 Cr)** (Power Electronics) **SELEC552 (4 Cr)** (Mechatronics and robotics) | **SELEE551 (4 Cr)** ***(From same Department /School)*** (A) Programming in Python **OR** (B) Signal & System | **SVECP 551** Publication Ethics **(2 Cr)** | | Research Project **SELER552 (6 Cr)** | **SELEP551 (1Cr)** (Power Electronics Lab-) **SELEE552 (1Cr)** (Robotics Lab-) | **22** | |
| **Total Credits** | | **44** | **14** | **05** | **03** | **10** | **12** | **88** | |

# M. Sc. First Year Semester I *(Level 6.0)*

## *Teaching Scheme*

| | Course Code | Course Name | Credits Assigned | | | Teaching Scheme (Hrs/ week) | |
|---|---|---|---|---|---|---|---|
| | | | Theory | Practical | Total | Theory | Practical |
| **Major** | **SELEC401** | **Semiconductor Devices and Technology** | 04 | -- | **04** | 04 | -- |
| | **SELEC402** | **Embedded System Design** | 04 | -- | **04** | 04 | -- |
| | **SELEC403** | **Measurement & Instrumentation** | 04 | -- | **04** | 04 | -- |
| **Elective (DSE)** | **SELEE401** | **Programming in C/C++ OR Internet of Things** | 03 | -- | **03** | 03 | -- |
| **Research Methodology** | **SVECR401** | | 03 | -- | **03** | 03 | -- |
| **ELE /DSE Practical** | **SELEP401** | **Semiconductor Lab** | -- | 01 | **01** | -- | 02 |
| | **SELEP402** | **Embedded Lab** | -- | 01 | **01** | -- | 02 |
| | **SELEP403** | **Instrumentation Lab** | -- | 01 | **01** | -- | 02 |
| | **SELEP404** | **C-Prog. Lab** | | 01 | **01** | -- | 02 |
| **Total Credits** | | | **18** | **04** | **22** | **18** | **08** |

# M. Sc. First Year Semester II *(Level 6.0)*

## *Teaching Scheme*

| | Course Code | Course Name | Credits Assigned | | | Teaching Scheme (Hrs/ week) | |
|---|---|---|---|---|---|---|---|
| | | | Theory | Practical | Total | Theory | Practical |
| **Major** | **SELEC451** | **Digital System Design** | 04 | -- | **04** | 04 | -- |
| | **SELEC452** | **Fiber Optics Communication** | 04 | -- | **04** | 04 | -- |
| | **SELEC453** | **Network Analysis** | 04 | -- | **04** | 04 | -- |
| **Elective (DSE)** | **SELEE451** | **Introduction to JAVA OR Digital Image Processing** | 03 | -- | **03** | 03 | -- |
| **On Job Training** | **SELEOJ451** | | -- | 03 | **03** | -- | 06 |
| **ELE / DSE Practical** | **SELEP451** | **Digital Lab** | -- | 01 | **01** | -- | 02 |
| | **SELEP452** | **Fiber Optic Lab** | | 01 | **01** | -- | 02 |
| | **SELEP453** | **Network Lab** | -- | 01 | **01** | -- | 02 |
| | **SELEP454** | **Java- Lab** | -- | 01 | **01** | -- | 02 |
| **Total Credits** | | | **15** | **07** | **22** | **15** | **14** |

# SELEC401: Semiconductor Devices and Technology

**Periods : 60 Hours** **Max Marks:100 (ESE:80+CA:20)** **Credits :4**

**Course Objectives:**

1. To make the students understand the fundamentals of electronic devices.
2. To train them to apply these devices in mostly used and important applications.
3. Exploring Fabrication Techniques of semiconductor devices
4. Course aims to provide students with the ability to analyze and interpret device characteristics

**Course Outcomes:**

After learning this course student will be able to

1. Explore the structure of solids, charge carriers and energy level
2. Understand carrier transport , generation and recombination processes
3. Discover the semiconductor junctions in BJT, FET, MOSFET and optical devices
4. Know the basic steps in making Integrated circuits

| Unit | Topic | No. of Hrs required to cover the contents |
|---|---|---|
| | **Semiconductor material properties** | **15** |
| **I** | Crystal structure of solids: Semiconductor materials, types of solids, basics of Crystallography, space lattice, atomic bonding, and unit cell, Miller indices, imperfections and impurities in solids.<br>Allowed & forbidden energy bands, Electric conduction, density of states, Statistical laws,<br>Fermi-Dirac probability function, the distribution function and the Fermi energy.<br>Semiconductor in equilibrium: Charge carriers in semiconductors, dopant atoms and energy levels, extrinsic semiconductors, Statistics of donors and acceptors, charge neutrality, position of Fermi energy level. | |
| | **Physics of semiconductors and pn junction** | **15** |
| **II** | Carrier transport phenomena: charge, effective mass, state & carrier distributions, Carrier drift, carrier diffusion, resistivity, Hall Effect.<br>Non-equilibrium excess carriers in semiconductors: Carrier generation and Recombination, Quasi-Fermi Energy levels.<br>The pn junction: Basic Structure of the pn junction, Zero applied bias, Reverse applied bias, Junction breakdown, pn junction current, generation and recombination currents, Metal semiconductor junctions | |
| | **Basics of Semiconductor Devices** | **15** |
| **III** | BJT: Bipolar transistor action, Eber-Moll model, hybrid – pi model, Non-ideal effects. FETs: JFET and MESFET concepts, characteristics. Small signal equivalent circuit.<br>MOSFETs: MOS and MOSFET Structure, Capacitance- Voltage characteristics, small signal equivalent circuit Optical Absorption, Solar Cell- I-V Characteristics, Photo detector, photodiode, PIN photodiode, Avalanche photodiode, phototransistor Photoluminescence and Electroluminescence. LEDs: Internal and External quantum efficiency. LASER Diodes: Stimulated emission and population inversion, optical cavity, threshold Current, device structure and characteristics. | |

| | | |
|---|---|---|
| | **IC Fabrication Technology** | |
| **Unit IV** | Crystal growth, epitaxy, oxidation, lithography, doping, etching, isolation methods, metallization, bonding, Thin film deposition and characterization Techniques: XRD, TEM, SEM, EDX, Thin film active and passive devices. MOS technology and VLSI | **15** |
| | **Total** | **60** |

**References:**


1. Semiconductor Physics and Devices Basic Principles, Donald A. Neamen, TMH, 3 rd Edition
2. Semiconductor Device fundamentals, Robert F. Pierret, Pearson Education
3. Solid State Electronics Devices, Streetman, PHI, 5th Edition, (2006)
4. Integrated Circuits, K.R. Botkar, Khanna publishers**,**10th edition,(2012)

# SELEC402: Embedded System Design

**Periods : 60 Hours** **Max Marks:100 (ESE:80+CA:20)** **Credits :4**

**Course Objectives:**

1. Understand the fundamentals of embedded systems
2. Gain knowledge of programming languages for embedded systems
3. Learn about embedded system architecture and hardware-software co-design
4. Develop skills in embedded software development

**Course Outcomes:**

1. Explore different components and software tools in embedded systems.
2. Distinguish between microprocessor and microcontroller architectures.
3. Understand different microcontroller architectures and instruction set.
4. Acquires ability to design and interface different types devices with microcontroller.
5. Explore popular communication protocols for embedded systems.

| Unit | Topic | No. of Hrs required to cover the contents |
|---|---|---|
| | **Introduction to Microcontroller 8051** | **15** |
| **I** | Introduction to embedded systems, classifications, processor in the system, microcontroller, Introduction to 8051: 8051 architecture, features of 8051, pin diagram, memory, Special function register. | |
| | **8051 Interfacing & Programming** | **15** |
| **II** | LCD interfacing, Keyboard, LED interfacing. ADC interfacing to 8051, DAC interfacing, Relay, PWM, DC and stepper moto racing with 8255: Programming the 8255, 8255 interfacing, C programming for 8255. Sensors: LM35, PIR Sensor, IR Sensor. | |
| | **AVR and PIC Microcontroller** | **15** |
| **III** | Introduction to Microcontrollers, specifications, features, selection criteria for a microcontroller, Memory hierarchy and their interfaces. Input- Output interfaces synchronous and asynchronous transfers, interrupts, Timer/Counter, PWM. | |
| | **Communication Protocols and Interfacing** | **15** |
| **IV** | Communication Protocols: I2C, SPI, CAN etc...<br>Interfacing with the microcontrollers and programming in C: Keyboard, display SSD, dot matrix display, and LCD display (text and graphic), sensors, signal conditioning, ADC's, EEPROM, DAC, Motors (DC, stepper, and servo), RTC. | |
| | **Total** | **60** |

**References:**


1. Mohammad Ali Mazidi, Rolin D McKinley, Janice G Mazidi, "The 8051 Microcontroller and Embedded Systems", Second Edition, Prentice Hall
2. Microprocessor and Microcontroller by R. Theagarajan, Sci Tech Publication, Chennai.
3. AVR Microcontroller and Embedded Systems using Assembly and C, Mazidi and Naimi, Pearson education, 2013.
4. PIC Microcontroller and Embedded Systems, Mazidi, Mckinlay and Causey, Pearson,2008

# SELEC403: Measurement & Instrumentation

**Periods : 60 Hours** **Max Marks:100 (ESE:80+CA:20)** **Credits :4**

**Course Objectives:**

1. Understand the fundamental principles of instrumentation
2. Understand the working of different transducers
3. Gain knowledge of different types of instruments
4. Develop skills in instrumentation system design

**Course Outcomes:**

1. Know working principles of sensors /transducers and their applications.
2. Understand measurement principles of various physical parameters.
3. Explore electrical measurement systems.
4. Able to use of various transducers in bio-medical and industrial applications.
5. Able to read datasheets and select various transducers for various applications.

| Unit | Topic | No. of Hrs. Required to cover the contents |
|---|---|---|
| **I** | **Introduction to Transducers:** Methods of transduction, primary sensing elements and transducers, electrical transducers, classification of transducers types of transducers- Resistance, Inductance, Capacitance, Piezoelectric, Thermometric, Hall effect, Photoelectric | **15** |
| **II** | **Measurement of Physical Quantities**<br>Measurement of different physical parameters and their sensors and transducers of displacement,<br>velocity, acceleration, force, torque, strain, temperature, pressure, flow, humidity, thickness, pH | **15** |
| **III** | **Measuring Equipments**<br>Measuring Equipment -Measurement of R, L and C, Bridge and potentiometer, voltage, current,<br>power, energy, frequency/time, phase, Digital Multi meters, CRO, Digital Storage Oscilloscope,<br>Spectrum Analyzer | **15** |
| **IV** | **Biomedical Instruments**<br>Biomedical Instruments- ECG, EEG, Blood Pressure Measurements, MEMS and its applications<br>Sensors for IoT applications | **15** |
| | **Total** | **60** |

**References:**


1. A Course in Electrical and Electronic Measurements and Instrumentation, A.K. Sawhney, Dhanpat Rai & Co (2007)
2. Electronic Instrumentation, Kalsi, TMH (2009)
3. Bio medical Instrumentation, R.S. Khandpur, 2nd edition, Tata McGraw hill (2004)
4. Sensors and transducers, principles and applications, R.Y.Borse (2012).

# SELEE401(A): Programming in C/C++

**Periods : 45 Hours** **Max Marks:75 (ESE:60+CA:15)** **Credits :3**

**Course Objectives:**

1. The course is designed for to providing knowledge of C & C++.
2. Students will be able to develop logics which will help them to create programs, applications.

**Course Outcomes:**

1. Understand the basic syntax, data types, and control structures of the C/C++ programming
2. Demonstrate proficiency in writing C/C++ programs to solve computational problems.
3. Apply modular programming concepts by designing & implementing functions and libraries in C/C++.
4. Utilize appropriate data structures, such as arrays, strings, and structures, to organize and manipulate data in C/C++ programs.
5. Understand and apply the principles of object-oriented programming (OOP) in C++ by designing classes, objects, and inheritance relationships.

| Unit | Topic | No. of Hrs. required to cover the contents |
|---|---|---|
| I | **Introduction to C/C++ Programming**: Introduction to programming concepts , Overview of the C/C++ programming languages , Basics of C/C++ programming: syntax, data types, variables, operators, and expressions , Input and output operations | **10** |
| II | **Control Structures**<br>Decision-making statements: Looping statements: ntroduction to functions ,Defining and calling functions, Function prototypes and header files Introduction to arrays<br>Declaring and initializing arrays ,Array indexing and accessing elements | **11** |
| III | **Object-Oriented Programming in C++:**<br>Introduction to object-oriented programming (OOP)<br>Classes and objects, Data abstraction and encapsulation , Inheritance and polymorphism<br>Constructors and destructors ,Function overloading and operator overloading<br>Exception handling | **13** |
| IV | **Dynamic Memory Allocation**<br>Concept of Dynamic Allocation<br>Implementing Malloc and Calloc Functions<br>Releasing the free space | **11** |
| | **Total** | **45** |

**References :**


1."The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie

2. "C++ Primer" by Stanley B. Lippman, Josée Lajoie, and Barbara E. Moo

3. C Programming Absolute Beginner's Guide" by Greg Perry and Dean Miller

# SELEE401(B): Internet of Things

**Periods : 45 Hours** **Max Marks:75 (ESE:60+CA:15)** **Credits :3**

**Course Objectives:**

1. Understand the fundamentals of IoT
2. Gain knowledge of IoT architectures and protocols
3. Learn about IoT hardware platforms and devices

**Course Outcomes:**

1. Understand the fundamental concepts and principles of the Internet of Things, including its definition, characteristics, and potential applications.
2. Gain knowledge of different components and technologies involved in IoT systems, such as sensors, actuators, embedded systems, wireless communication protocols, and cloud computing.
3. Demonstrate proficiency in designing and implementing IoT solutions using hardware platforms like Arduino, Raspberry Pi, or microcontrollers.
4. Understand the concepts of data acquisition, data processing, and data analytics in IoT systems.

| Unit | Topic | No. of Hrs. required to cover the contents |
|---|---|---|
| **I** | **Fundamentals of IoT** | **11** |
| | What is the Internet of Things? History of IoT, About IoT, Overview and Motivations, Examples of Applications, Internet of Things Definitions and Frameworks : IoT Definitions, IoT Architecture, General Observations, ITU-T Views, Working Definition, IoT Frameworks, Basic Nodal Capabilities | |
| **II** | **Fundamental IoT Mechanisms and Key Technologies** | **11** |
| | Identification of IoT Objects and Services, Structural Aspects of the IoT, Environment Characteristics, Traffic Characteristics, Scalability, Interoperability, Security and Privacy, Open Architecture, Key IoT Technologies, Device Intelligence, Communication Capabilities, Mobility Support, Device Power, Sensor Technology, RFID Technology, Satellite Technology, | |
| **III** | **Resource Management in the Internet of Things** | **12** |
| | Clustering, Software Agents, Clustering Principles in an Internet of Things Architecture, Design Guidelines, and Software Agents for Object Representation, Data Synchronization. Identity portrayal, Identity management, various identity management models: Local, Network, Federated and global web identity, user-centric identity management, device centric identity management and hybrid-identity management, Identity and trust. | |
| **IV** | **RFID Systems** | **11** |
| | Introduction, Principle of RFID, Components of an RFID system, Issues EPC Global Architecture Framework: EPCIS & ONS, Design issues, Technological challenges, Security challenges, IP for IoT, Web of Things. | |
| | **Total** | **45** |

**References:**


1. Rafel C. Gonzalez and Richard .E. Woods, Digital Image Processing, Third Edition, Pearson(2008)
2. Malay K. Pakhira: Digital Image Processing and Pattern Recognition. PHI (2011)
3. Rafel C. Gonzalez, Richard E. Woods and Steven L. Eddins, Digital Image Processing using MATLAB, Pearson 2004
4. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson, 2002
5. Keenneth R Castleman, Digital Image Processing, Pearson Education, 1995

## SELEP401: Semiconductor Lab

Periods : 15 Hours Max Marks:25 (ESE:20+CA:05) Credits :1

1) Solar Cell- I-V Characteristics
2) Zener Diode as voltage Regulator
3) FET Characteristics Study
4) Study of Hall effect sensor
5) Study of LASER diode
6) Study of Photoluminescence / Electroluminescence

## SELEP402: Embedded Lab

Periods : 15 Hours Max Marks:25 (ESE:20+CA:05) Credits :1

1) Write program to interface Led with 8051
2) Study of PWM generation of different frequency
3) Study of interfacing the LCD 16 x 2 with PIC microcontroller
4) Study of interfacing of dc motor and control its direction of rotation.
5) Data Transfer using I2C protocol
6) Proximity sensor interfacing with AVR Controller

## SELEP403: Instrumentation Lab

Periods: 15 Hours Max Marks: 25 (ESE:20+CA:05) Credits: 1

1) Study of Thermistor (NTC/PTC)
2) Measurement of R, L and C
3) Study of Piezoelectric Effect
4) CRO Handling
5) Data acquisition uisng IOT sensor
6) Study of Displacement Transducer

## SELEP404: C-programming Lab

Periods: 15 Hours Max Marks: 25 (ESE:20+CA:05) Credits: 1

1) Object-Oriented Programming (OOP): Create programs using OOP concepts such as classes, objects, inheritance, polymorphism, and encapsulation.

2) Dynamic Memory Allocation: Implement programs that demonstrate dynamic memory allocation using pointers and memory management techniques.

3) Matrix Operations: Write a program to perform matrix operations, including addition, subtraction, multiplication, and transpose.

4) Simple Calculator: Implement a program that performs basic arithmetic operations based on user input.

5) Array Operations: Perform various operations on arrays, such as sorting, searching, and manipulation.

6) Fibonacci Series: Write a program to generate the Fibonacci series up to a specified limit.

# SELEC451: Digital System Design

**Periods : 60 Hours** **Max Marks:100 (ESE:80+CA:80)** **Credits :4**

**Course Objectives:**

1. Introduce the concept of digital and binary systems
2. Be able to design and analyze combinational logic circuits.
3. Be able to design and analyze sequential logic circuits.

**Course Outcomes:**

1. Understand the fundamental concepts of digital systems, including Boolean algebra, logic gates, and combinational and sequential circuits.
2. Gain knowledge of different number systems, such as binary, hexadecimal, and octal, and their applications in digital systems.
3. Demonstrate proficiency in designing and implementing combinational logic circuits, including encoders, decoders, multiplexers, and demultiplexers.
4. Design and analyze sequential logic circuits, including flip-flops, registers, counters, and state machines. Utilize hardware description languages (HDLs) such as VHDL or Verilog for modeling and simulation of digital systems.

| Unit | Topic | No. of Hrs. required to cover the contents |
|---|---|---|
| **I** | **Fundamentals of Digital Logic ICs** | **15** |
| | Logic Families: Characteristics of digital ICs, Bipolar Logic Families: operation of Transistor-Transistor logic (TTL) Tri-State Logic. Unipolar logic Families: PMOS, NMOS, and CMOS. Logic Family, Comparison. | |
| **II** | **Combinational Logic Circuit Design** | **15** |
| | Standard representation for Logic functions, Sum-of-Products and Product-of-Sums methods. Simplification of Logic functions using Karnaugh Map, Don't care conditions, Design examples on Arithmetic building blocks: Half–adder, Full-adder, Half-subtractor, Full-subtractor, Binary to Gray and Gray to Binary code converters. | |
| **III** | **Data-Processing Circuits** | **15** |
| | Parallel Adder (IC7483), Arithmetic logic Unit (IC 74181), Multiplexers, Demultiplexers, multiplexers/ Demultiplexers Trees, BCD to Seven-segment Decoders, Encoders, Parity Generators and Checkers, Comparator. | |
| **IV** | **Sequential Logic Circuit Design** | **15** |
| | Flip-Flops: Memory Cell, R-S, J-K, Race around condition, Master-Slave J-K, D, T, excitation table, Flip-Flop conversion, Counter: Design of asynchronous (ripple) counter, 4 bit Up/Down counter, Design of synchronous counter using ICs, 4 bit Up/Down, MOD-N counters, Shift Registers: SISO, SIPO, PISO, PIPO, Right shift, Let shift, IC7495/74195 | |
| | **Total** | **60** |

**References:**


1. Donald P Leach, Albert Paul Malvino, Goutam Saha "Digital Principles and Applications", Mc Graw Hill.
2. Morris Mano "Digital Logic & Computer Design", Pearson.
3. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss "Digital Systems,Principles and Applications", Pearson, Tenth Edition.
4. G. N. Shinde "Digital Electronics with Practical Approach", Shivani Publication.

# SELEC452: Fiber Optics Communication

Periods : 60 Hours  Max Marks:100 (ESE:80+CA:20)  Credits :4

**Course Objectives:**

1. To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
2 .To understand the different kind of losses, signal distortion, SM fibers.
3. To learn the various optical sources, materials and fiber splicing

**Course Outcomes:**

1. Be familiar with Optical Fiber Communication System and its parameters including single and multimode fibers, fiber couplers, connectors etc..
2. Demonstrate basic fiber handling skills, including cleaving and splicing.
3. Understand and measure properties of optical sources, detectors and receivers.
4. Design, construct and test a basic optical fiber communication link/system.
5. Write a good technical report and clear and informative presentation.

| Unit | Topic | No. of Hrs. Required to cover the contents |
|---|---|---|
| **I** | **Display Devices** | **15** |
| | Lamps and illumination systems, LEDs – working principle and applications, LED lighting,Display devices, indicators, numeric, alphanumeric and special function displays, Liquid Crystal Display elements, Plasma Displays, Semiconductor lasers, - Fabry-Perot lasers, Distributed Feedback, (DFB) lasers, Distributed Bragg Reflection (DBR) lasers | |
| **II** | **Opto-electronic Devices** | **15** |
| | Photodetectors types and applications, PN and PIN Photodiodes, Avalanche Photodiodes (APD)Optocouplers, Opto interrupters, LASCR. used in safety interlocks, power isolators, rotary and linear encoders and remote control. Intrinsic and Extrinsic Fiber optic sensors. | |
| **III** | **Fundamentals of Optical Fibers** | **15** |
| | Optical Fiber Theory, Parameters of Optical Fibers, Types of Optical Fibers: Single Mode and Multi-Mode Fibers, Step Index & Graded Index Fibers. Modal Properties: Waveguide Parameter (V Number), Cut-off wavelength, Dispersion-Intermodal and Intramodal dispersion Loss Mechanism in Optical Fibers-Adsorption and Scattering, Fresnel Reflection, Micro bending & Macro bending, Connector types and Splices, Misalignment and Mismatch losses. | |
| **IV** | **Fiber-Optic Communication** | **15** |
| | Fiber-Optic transmitters and receivers, Direct Modulators, External Modulators-Electro-Optic Modulators, Electro-Absorption Modulators, Noise in detection process, Noise Equivalent Power (NEP). Single Channel System Design, Power budgeting, Transmission Capacity Budgeting, Dispersion Compensation, Nonlinear effects in optical fibers-Stimulated Brillouin Scattering (SBS), Self-Phase Modulation (SPM) | |
| | **Total** | **60** |

**References:**


1. John M. Senior: Optical fiber communications, Principles and Practice, PHI.
2. Charles K Kao: Optical fiber systems, Technology design and applications, Mc- Graw Hill Int. Ed.
3. Gerd Keiser: Optical fiber communications, Mc-Graw Hill International Edition.
4. J. Gower: Optical fiber communication, PHI.
5. Franz and Jain: Optical communications: components and systems; Narosa Publishing House.

# SELEC453: Network Analysis

Periods : 60 Hours  Max Marks:75 (ESE:80+CA:20)  Credits :4

**Course Objectives:**

1. To make the students capable of analyzing any given electrical network
2. Understanding of concepts and principles of passive circuit analysis and synthesis.
3. Ability to solve complex circuits using different theorems and methods.

**Course Outcomes:**

1. Analyse the network using different laws and theorems.
2. Identify continuous- and discrete-time signals and systems.
3. Apply Laplace, Fourier and Z transform.
4. Distinguish and use CT and DT filters.
5. Perform Fourier analysis of continuous- time signals and systems.

| Unit | Topic | No. of Hrs. required to cover the contents |
|---|---|---|
| **I** | **Introduction to Network Theorem** | **15** |
| | Network Analysis Mesh analysis, mesh equations, super-mesh analysis; nodal analysis, nodal equations; source transformation technique; graph theory and network equations: graph of a network, trees and co-trees, twigs and links, incidence matrix, tie set matrix, cut set matrix; state variable analysis; time domain analysis: steady state and transient response, DC response of RL, RC and RLC circuit, sinusoidal response of RL, RC and RLC circuit | |
| **II** | **Network Analysis** | **15** |
| | Network Theorems and Applications Star-delta transformations; network theorems: superposition, maximum power transfer, Thevenin's, Norton's and reciprocity, duals and duality, Tellegen's and Millman's theorem with suitable examples | |
| **III** | **Laplace Transform for Circuit Analysis** | **15** |
| | Laplace Transform and Properties of Laplace transformation, properties of Laplace transforms, partial fraction expansion, Inverse Laplace transforms, Heaviside's expansion theorem: illustrative examples, application of the Laplace transform in circuit analysis. | |
| **IV** | **Network Parameters** | **15** |
| | Network Functions and synthesis Techniques One-port and two-port networks, of synthesis of RC and LC networks two-port network parameters: open circuit impedance, short circuit admittance, transmission, inverse transmission, hybrid, inverse hybrid parameters, interrelationship of different parameters, interconnections of two port networks. | |
| | **Total** | **60** |

**References:**


1. Network Analysis: M. E. Van Valkenberg, PHI, New Delhi.
2. Circuits and Networks: Analysis and Synthesis: A. Sudhakar and S. P. Shyammohan, Tata McGraw Hill, New Delhi.
3. Networks and Systems: D. Roy Choudhuri, New Age International (P) Limited, Publishers, New Delhi.

# SELEE451(A): Introduction to JAVA

Periods : 45 Hours  Max Marks:75 (ESE:60+CA:15)  Credits :3

**Course Objectives:**

1. To learn why Java is useful for the design of desktop and web applications.
2. To learn how to implement object-oriented designs with Java.
3. To identify Java language components and how they work together in applications.
4. To design and program stand-alone Java applications.

**Course Outcomes:**

1. Understand the fundamental concepts of object-oriented programming (OOP) and apply them in Java programming.
2. Demonstrate proficiency in the syntax, semantics, and basic features of the Java programming language.
3. Utilize Java standard library classes and packages for performing various tasks such as file input/output, string manipulation, and collection handling.
4. Utilize control structures and decision-making statements to create flow control in Java programs.

| Unit | Topic | No. of Hrs. required to cover the contents |
|---|---|---|
| **I** | **Overview of Java language** | **12** |
| | Java Evolution History, Java Features: Compiled and interpreted-Platform Independent and portable-Object Oriented-paradigm-Objects and classes, Robust and secure-Distributed- Simple small and familiar-Multi threaded and interactive-High Performance-Dynamic and extensible Easy and development-Garbage Collected-Java support systems-Java environment-Java development kit-Java run time environment, Classification of Java Statement, Installation and Configuration of Java, Java virtual machine, Overview of Java language: Class declaration Main line-Output line-Simple java program, Java Program Structure | |
| **II** | **Data types and Variables of Java** | **12** |
| | Constants, Variables and Data type: Declaration and initialization of constants & variables Scope of variables-Data types, Java Operators and Expression: Arithmetic-Relational Logical- Assignment-Increment & decrement-Conditional-Bit wise-Special, Decision Making and Branching: if statement-if else statement-Nesting of if else statement-else if ladder-switch statement-"? :" operator, Decision Making and Looping: while statement-do while statement for statement-Jump in loop-Labeled loop, Arrays and String: One, two, multi-dimensional array- Creating an array-Strings. | |
| **III** | **Object Oriented Programming** | **11** |
| | OOPs: Defining class-Fields Declaration-Method Declaration-Creating Object-Accessing class members-Invoking Method-Member variables vs. Local variables-Passing Arguments to Methods-Returning multiple values from methods-Constructor-Method overloading- Static member-Nesting of method, Final variables and method-final class - finalizer method abstract method and class-Dynamic method dispatch-Visibility control. | |
| **IV** | **Multi threaded Programming** | **10** |
| | Creating threads- Extending the thread class- stopping and blocking a thread- Life cycle of a thread – Using thread methods-thread exceptions – thread priority synchronization. | |
| | **Total** | **45** |

**References:**


1. Computing concepts with java 2 essentials, CAY HORSTMANN 2 Edition
2. Big java by CAY HORSTMANN, 2 Edition, WILEY INDIA ISBN 81-265-0879-5
3. Web Design, The complete reference, Thomas A. Powel, Tata McGraw Hill.
4. Programming with JAVA primer, E. Balagurusamy, Tata McGraw Hill.

# SELEE451 (B): Digital Image Processing

Periods : 45 Hours  Max Marks:75 (ESE:60+CA:15)  Credits :3

**Course Objectives:**

1. Understand the fundamentals of digital image processing
2. Gain knowledge of image filtering and restoration techniques
3. Learn about image transformation and compression
4. Explore image segmentation and feature extraction

**Course Outcomes:**

1. Understand the fundamental concepts and principles of digital image processing.
2. Gain knowledge of the basic mathematical and statistical techniques used in image processing.
3. Acquire proficiency in using image processing tools and software, such as MATLAB, OpenCV, or other programming libraries.
4. Apply various image enhancement techniques to improve the quality and clarity of digital images.
5. Implement image restoration techniques to reduce noise, blur, and other types of image degradation.

| Unit | Topic | No. of Hrs. required to cover the contents |
|---|---|---|
| **I** | **Basic Components of Image Processing** | **12** |
| | Introduction to Digital Image Processing Basic components of image processing system, image sensing and acquisition, digital camera working principle; image sampling and quantization; representation of digital images, matrix, pyramid, quad-tree; elements of color image processing, hue, saturation and intensity, chromaticity diagram | |
| **II** | **Image Enhancement** | **12** |
| | Image Enhancement, Filtering and restoration Enhancement in spatial domain; pixel grey level transformation, image negatives, logarithmic transformation; bit-plane slicing, histogram processing; enhancement in frequency domain; image smoothing (low pass filter), image sharpening (high pass filter), selective filtering (band pass and band reject filters); noise models for images, signal-to-noise ratio, image restoration in the presence of noise using spatial filtering, periodic noise reduction by frequency domain filtering; estimating the degradation | |
| **III** | **Image Processing** | **11** |
| | Color Image Processing and Image Segmentation Color fundamentals, color models, RGB, CMY and CMYK color models, HSI model; pseudo-color image processing, basics of full color processing, color transformations, smoothing and sharpening; noise in color images, grey level to color transformation; | |
| **IV** | **Image Segmentation** | **10** |
| | Image Segmentation: fundamentals, edge-based segmentation; image thresholding, intensity thresholding; basic global thresholding, multi-variable thresholding. Applications | |
| | **Total** | **45** |

**References:**


1. Rafel C. Gonzalez and Richard .E. Woods, Digital Image Processing, Third Ed., Pearson(2008)
2. Malay K. Pakhira: Digital Image Processing and Pattern Recognition. PHI (2011)
3. Rafel C. Gonzalez, Richard .E. Woods and Steven L. Eddins, Digital Image Processing using MATLAB, Pearson 2004
4. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson, 2002
5. Keenneth R Castleman, Digital Image Processing, Pearson Education, 1995

## SELEP451: Digital Lab

Periods : 15 Hours  Max Marks:25 (ESE:20+CA:05)  Credits :1

1) To design and build BCD-to-7 segment converter
2) To design and test A 4-bit binary parallel adder.
3) BCD TO EXCESS- 3 Code Converter
4) To realize and study of Shift Register. 1) SISO 2) SIPO) 3) PIPO 4) PISO
5) To realize and study Ring Counter and Johnson counter.
6) To design and test 3-bit binary synchronous counter using flip-flop IC 7476 .

## SELEP452: Fiber Optic Lab

Periods : 15 Hours  Max Marks:25 (ESE:20+CA:05)  Credits :1

1) Measurement of Mode field diameter of a single mode fiber.
2) Measurement of Dispersion of optical fiber.
3) Performance of PAM on fiber optic link.
4) Performance of PWM on fiber optic link.
5) Performance of PPM on fiber optic link.
6) Measurement of NA of a multi mode fiber.

## SELEP453: Network Lab

Periods : 15 Hours  Max Marks:25 (ESE:20+CA:05)  Credits :1

1) Verification of principle of superposition with dc and ac sources.
2) Verification of Thevenin, Norton and Maximum power transfer theorems
3) Verification of Tellegin's theorem for two networks of the same topology.
4) Study of Transmission and hybrid parameters
5) Reciprocity and Millmann's Theorems
6) Study of Maximum power transfer theorem

## SELEP454: JAVA -Programming Lab

Periods : 15 Hours  Max Marks:25 (ESE:20+CA:05)  Credits :1

1. Object-Oriented Programming (OOP): Create programs using OOP concepts such as classes, objects, inheritance, polymorphism, and encapsulation.
2. Dynamic Memory Allocation: Implement programs that demonstrate dynamic memory allocation using pointers and memory management techniques.
3. Matrix Operations: Write a program to perform matrix operations, including addition, subtraction, multiplication, and transpose.
4. Simple Calculator: Implement a program that performs basic arithmetic operations based on user input.
5. Array Operations: Perform various operations on arrays, such as sorting, searching, and manipulation.
6. Fibonacci Series: Write a program to generate the Fibonacci series up to a specified limit.