॥ 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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संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील M. Sc. Electronics प्रथम वर्षाचा अभ्यासक्रम शैक्षणिक वर्ष २०२१–२२ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, **दिनांक २१ सप्टेंबर २०२१ रोजी संपन्न झालेल्या ५२ व्या मा. विद्या परिषद बैठकीतील ऐनवेळचा विषय क्र. ४/५२–२०२१** च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या **संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील** M. Sc. Electronics **प्रथम वर्षाच्या C.B.C.S. (Choice Based Credit System) Pattern** नुसारच्या अभ्यासक्रम शैक्षणिक वर्ष २०२१–२२ पासून लागू करण्यात येत आहे.

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.: शैक्षणिक–१/परिपत्रक/पदव्युत्तर–सीबीसीएस अभ्यासक्रम/२०२१–२२/**१५२**
दिनांक : ०४.१०.२०२१.

स्वाक्षरित
सहा.कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :

१) मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.
७) अधीक्षक, परिक्षा विभाग विज्ञान व तंत्रज्ञान विद्याशाखा प्रस्तुत विद्यापीठ.

SWAMI RAMANAND TEERTH MATHAWADA UNIVERSITY, NANDED

Syllabus of M.Sc. in Electronics (CBCS)

Preamble:

Outline of the '*M.Sc. in Electronics*' program (Choice Based Credit System):

The 2 year or 4 semesters '*M. Sc. in Electronics*' program will have a total of 100 credits.

The number of credits is based on the number of contact hours/week.

The features of the CBCS system for '*M.Sc. in Electronics*' are:

1. The courses offered in MSc program are classified as core, soft core and electives.
2. The choice based course may be offered within the faculty of science and technology.
3. The course curricula are structured in 4 units each.
4. There is an end of term project in the 4th semester. Candidates are encouraged to carry out the project work in government research organizations / recognized R & D centers or industries, so that they get lot of exposure to the industrial environment. Students can also do their project work within the department. All permanent faculty members and guest faculty members with more than three years of teaching experience are the project guides / internal Guides. Teachers, scientists in other organizations, who are guiding the candidates shall be the external guides. The project report / dissertation shall be submitted at the end of the 4th semester.
5. Scheme of examination is as per the university guidelines.
6. The declaration of results is based on the CGPA earned at the end of each semester and the CGPA at the end of the program.

Objectives of '*M.Sc. in Electronics*' program:

- To develop skills of critical thinking, hypothesis building and applying the Electronics concepts, theoretical models and laboratory experiments.
- To develop problem solving skill for identifying and formulating problems independently and creatively employing the theoretical and / or experimental methods that he/she has acquired during the course.
- To train the students with a working knowledge of experimental / computational techniques and instrumentation required to work independently in research and industrial environments.
- To acquire advance knowledge in specialized areas in Electronics that are in tune with the front-line research in Electronics.
- To prepare the students to compete for current employment opportunities.

Program Outcome:

Students after completing their post-graduation in Electronics ---

1. will be eligible to get employment as an Assistant Professor, Teacher, etc. in private, semi government, government colleges.
2. can pursue their higher studies in related fields including M. Phill, Ph.D. in the national and international universities depending upon the eligibility conditions of the concerned universities.
3. work as research fellow, scientist in research institutes after qualifying NET/SET/PET examination.
4. can handle standard and advanced laboratory equipments, modern instruments.
5. be able to work as an electronic consultant, an electronic circuit designer, or as an entrepreneur.

Duration:

The duration of '*M. Sc. in Electronics*' program offered is of 2 Years (4 semesters) with a total of 100 credits, with total marks of 2500.

Eligibility for Admissions to '*M.Sc. in Electronics*' program:

1. A science graduate with 3 years of study and with a minimum of 50% marks in aggregate. Student must have **Electronics** or **Physics** as one of the optional subjects at UG level.
2. Preference will be given to the students having **Electronics** as one of the optional subject at UG level.
3. B.E. / B.Tech in Electronics with a minimum of 50% marks are also be eligible for the admission to 'M. Sc. in Electronics' program.
4. The admission procedures are as per the guidelines of the university.

Course Structure and Marking Scheme of M.Sc. Electronics First Year

M.Sc. First Year (Semester I)									
Course Code	**Course Type**	**Name of the Theory Course**	**Credits**	**Contact Hours Per Week**		**Total Hrs**	**Assessment Pattern (Marking Scheme)**		
				L	**P**		**CA**	**ESA**	**Total Marks**
ELE101	Core	Physics of Semiconductor Devices	04	04	--	60	25	75	100
ELE102	Core	Optoelectronics & Fiber Optics Communication	04	04	--	60	25	75	100
ELE103	Core	Digital Logic Design	04	04	--	60	25	75	100
ELE104	Core	**Elective Paper**	04	04	--	60	25	75	100
		A- Arduino Platform B- IoT	--	--	--	--	--	--	--
ELE105	Skill	Seminar/ Cyber Security / *MOOC: NPTL / SWAYAM	01	--	--	--	25	--	25
		Total Theory Course Credits -I	**17**	**--**	**--**	**240**	**125**	**300**	**425**
M.Sc. First Year (Semester II)									
ELE201	Core	Micro Controller and Interfacing	04	04	--	60	25	75	100
ELE202	Core	Op-amp & its Application	04	04	--	60	25	75	100
ELE203	Core	VHDL	04	04	--	60	25	75	100
ELE204	Core	**Elective Paper**	04	04	--	60	25	75	100
		A- Power Electronics B- Mechatronics	--	--	--	--	--	--	--
ELE205	Skill	Seminar / Android App development /*MOOC: NPTL/SWAYAM	01	--	--	--	25	--	25
		Total Theory Course Credits -II	**17**	**--**	**--**	**240**	**125**	**300**	**425**
Laboratory course *(Annual Pattern)*									
ELE106	Practical	Laboratory Course -I	04	--	04	60	25	75	100
ELE107	Practical	Laboratory Course -II	04	--	04	60	25	75	100
ELE206	Practical	Laboratory Course -III	04	--	04	60	25	75	100
ELE207	Practical	Laboratory Course -IV	04	--	04	60	25	75	100
		Total Laboratory Course	**16**	**--**	**--**	**240**	**100**	**300**	**400**
Total for M.Sc. I Year: Sem. I+ Sem. II + Lab Course work (Annual)			**50**	**--**	**--**	**720**	**350**	**900**	**1250**

* For Skill paper, student may opt for 1 seminar of 1 credit for Semester-I, and 1 seminar of 1 credit for Semester-II.

OR

* Student can opt for 1 MOOC: SWAYAM/NPTEL of 2 Credits for MSc First Year (Sem-I & Sem-II together).

Course Structure and Marking Scheme of M.Sc. Electronics Second Year

M. Sc. Second Year (Semester III)									
Course code	**Course Type**	**Name of the theory Course**	**Credits**	**Contact hours Per Week**			**Assessment pattern (Marking Scheme)**		
				L	**P**	**Total Hrs**	**CA**	**ESA**	**Total Marks**
ELE 301	Core	Industrial Process Control	04	04	--	60	25	75	100
ELE 302	Core	Network Analysis and Synthesis	04	04	--	60	25	75	100
ELE 303	Core	Python Programming for Electronics	04	04	--	60	25	75	100
ELE 304	Core	**Elective Paper**	04	04	--	60	25	75	100
		A-Virtual Instrumentation & Programming in Lab VIEW B- Signal & System	--	--	--	--	--	--	--
ELE 305	Skill	Seminar / PCB Design / **MOOC: NPTL / SWAYAM	01	--	--	--	25	--	25
		Total Theory Course Credits -III	**17**	**--**	**--**	**240**	**125**	**300**	**425**
M. Sc. Second Year (Semester IV)									
ELE 401	Core	Programmable Logic Controller	04	04	--	60	25	75	100
ELE 402	Core	Measurement & Instrumentation	04	04	--	60	25	75	100
ELE 403	Core	Advance Embedded System	04	04	--	60	25	75	100
ELE 404	Core	**Elective Paper**	04	04	--	60	25	75	100
		A- Digital Image Processing **B-** Introduction to JAVA	--	--	--	--	--	--	--
ELE 405	Skill	Seminar / Simulation Software / **MOOC: NPTL/SWAYAM	01	--	--	--	25	--	25
		Total Theory Course Credits -IV	**17**	**--**	**--**	**240**	**125**	**300**	**425**
Laboratory Course (Annual)									
ELE 306	Practical Core	Laboratory Course-V	04	--	04	60	25	75	100
ELE 307	Practical Core	Laboratory Course-VI	04	--	04	60	25	75	100
ELE 406	Practical Core	Major Project	08	--	08	120	50	150	200
		Total Laboratory Course	**16**	**--**	**--**	**240**	**100**	**300**	**400**
Total for M.Sc. II Year: Sem. III+ Sem. IV + Lab Course work (Annual)			**50**	**--**	**--**	**720**	**350**	**900**	**1250**
Grand Total Credits/Marks			**100**	**--**	**--**	**1440**	**700**	**1800**	**2500**

** For Skill paper, student may opt for 1 seminar of 1 credit for Semester-III, and 1 seminar of 1 credit for Semester-IV.

OR

** Student can opt for 1 MOOC: SWAYAM/NPTEL of 2 Credits for MSc Second Year (Sem-III & Sem-IV together).

ELE 101- Physics of Semiconductor Devices

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I: Introduction to Physics of Semiconductors **15 hours**

Types of solids, basics of crystallography, space lattice atomic bonding, unit cell, Miller indices imperfections and impurities in solids, methods for semiconductor crystal growth. Introduction to Quantum Mechanics: Principles of quantum mechanics, Schrodinger wave equation, and Applications of Schrodinger's wave equation.

Unit II: Semiconductor Fundamentals **15 hours**

Charge carriers in semiconductors, dopant atoms and energy levels, extrinsic semiconductors, Statistics of donors and acceptors, charge neutrality, position of Fermi energy level. Carrier transport phenomena: charge, effective mass, state & carrier distributions, Carrier drift, carrier diffusion, graded impurity distribution, resistivity, Hall effect. Carrier generation and recombination, characteristics of excess carriers, excess carrier lifetime, surface effects.

Unit III: Semiconductor Devices **15 hours**

BJT: Bipolar transistor action, Eber-Moll model, hybrid – pi model, Non-ideal effects. FETs: JFET and MESFET concepts, characteristics. Small signal equivalent circuit. MOSFETs: MOS and MOSFET Structure, characteristics, photo diode, PIN photo diode, Avalanche photodiode, photo transistor Photoluminescence and Electroluminescence. Diode: PN junction diode, PIN photo diode, Avalanche photodiode. Internal and External quantum efficiency of LEDs. LASER Diodes: Stimulated emission and population inversion, device structure and characteristics.

Unit IV : IC Fabrication Techniques **15 hours**

Fabrication technology 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

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)

ELE 102- Optoelectronics and Fiber Optics Communication

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit 1: Display Devices **15 hours**

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, Multimedia projectors. Semiconductor lasers, - Fabry-Perot lasers, Distributed Feedback, (DFB) lasers, Distributed Bragg Reflection (DBR) lasers

Unit 2: Opto-electronic Devices **15 hours**

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.

Unit 3: Fundamentals of Optical Fibers **15 hours**

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.

Unit 4: Fiber-optic Communication **15 hours**

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)

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.

ELE 103 - Digital Logic Design

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I: Fundamentals of Digital Logic ICs **15 hours**

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 of TTL, CMOS, ECL, RTL, I2L, DCTL logic families.

Unit II: Combinational Logic Circuit Design **15 hours**

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.

Unit III: Data-Processing Circuits **15 hours**

Parallel Adder (IC7483), Arithmetic logic Unit (IC 74181), Multiplexers, Demultiplexers, multiplexers/ Demultiplexers Trees, BCD to Seven-segment Decoders, Encoders, Parity Generators and Checkers, Comparator.

Unit IV: Sequential Logic Circuit Design **15 hours**

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 register: SISO, SIPO, PISO, PIPO, Right shift, Left shift, IC 7495 / 74195.

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.

ELE 104 A - Arduino Platforms (Elective)

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I: Introduction to Arduino **15 hours**

Getting Started with Arduino: Introduction to Arduino, Pin configuration and architecture. Device and platform features. Concept of digital and analog ports. Familiarizing with Arduino Interfacing Board Introduction to Embedded C and Arduino platform Basic Concepts: Arduino data types Variables and constants Operators Control Statements Arrays Functions

Unit II: **Arduino Time Incorporating** **15 hours**

Arduino Time Incorporating Arduino, time delay () function, delay Microseconds () function, millis () function, micros () function, Arduino Displays, Working with Serial Monitor, Line graph via serial monitor, Display: Interfacing 8 bit LCD to Arduino, OLED, Seven segment,

Unit III: Arduino Interfacing **15 hours**

Interfacing using the LCD Library of Arduino. Arduino Sensors, Arduino – Humidity Sensor Arduino – Temperature Senso, Arduino – Water Detector / Sensor, Arduino – PIR Sensor, Arduino – Ultrasonic Sensor, Arduino – Connecting Switch (Magnetic relay switches), Types of Relay, Controlling Electrical appliances with electromagnetic relays, Working of a matrix keypad, Using the keypad library to interface with Arduino, Interfacing Servo motors.

Unit IV: Arduino Communication **15 hours**

Serial Communication, I2c Communication, SPI Communication, Bluetooth, WIFI Communication, RF Communication, Controlling LED's with keys. Programming the Different Arduino Platform: Arduino Mega, Arduino Nano, Arduino Mini Pro

References:

1. Programming Arduino: Getting Started with Sketches (Tab) 2nd Edition.
2. Arduino For Dummies 1st Edition by John Nussey
3. Arduino Cookbook, 2nd Edition 2nd Edition
4. Beginning C for Arduino, Second Edition: Learn C Programming for the Arduino 2nd ed. Edition
5. https://www.arduino.cc/reference/en/

ELE 104 B – IoT (Elective)

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I: **Fundamentals of IoT** **15 hours**

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

Unit II: **Fundamental IoT Mechanisms and Key Technologies** **15 hours**

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,

Unit III: Radio Frequency Identification Technology RFID **15 hours**

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. Wireless Sensor Networks: History and context, WSN Architecture, the node, Connecting nodes, Networking Nodes, Securing Communication WSN specific IoT applications, challenges: Security, QoS, Configuration, Various integration approaches, Data link layer protocols, routing protocols and infrastructure establishment.

Unit IV: Resource Management in the Internet of Things **15 hours**

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.

Reference :

1. Hakima Chaouchi, " The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Willy Publications
2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2 nd Edition, Willy Publications
3. Daniel Kellmereit, Daniel Obodovski, "The Silent Intelligence: The Internet of Things",. Publisher: Lightning Source Inc; 1 edition (15 April 2014). ISBN-10: 0989973700, ISBN-13: 978- 0989973700. 4. Fang Zhaho, Leonidas Guibas, "Wireless Sensor Network: An information processing approach", Elsevier, ISBN: 978-81-8147-642-5.

ELE 201 - Microcontroller and Interfacing

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I: Introduction to Microcontroller 8051 **15 hours**

Introduction to embedded systems, classifications, processor in the system, microcontroller, Introduction to 8051: 8051 architecture, features of 8051, pin diagram, memory, Special function register.

Unit II: Instruction Set and Assembly Language Programing of 8051 **15 hours**

Assembly programming and instruction of 8051: Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming.

Unit III: Timer and Serial Port Programming of 8051 **15 hours**

Timer and Serial communication: timer of 8051, TMOD, programming of timer, programming of counter. basic of serial communication, SCON Register, 8051 connection to RS232, serial port programming, programming example Assembly and 'C' programming and instruction of 8051.

Unit IV: 8051 Interfacing **15 hours**

LCD interfacing, Keyboard, LED interfacing. ADC 0808/804 interfacing to 8051, Serial ADC Max1112 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.

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. Kenneth Ayala, "The 8051 Microcontroller", third edition, Penram international publications.

ELE 202 -Op-Amp and its Applications

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I: Fundamentals of OP-Amp **15 hours**

Introduction, The Operational Amplifier, Block Diagram Representation of a Typical Op-Amp, Analysis Of Typical Op-Amp Equivalent Circuit, Schematic Symbol, Integrated Circuits, The Ideal Op-Amp, Equivalent Circuit of an Op-Amp, Ideal Voltage Transfer Curve, Open-Loop Op-Amp Configuration, PSpice Simulation**:** Introduction, Input Offset Voltage,Input Basic Current, Input Offset Current, Total Output Offset Voltage, Change in Input Offset Voltage and Input Offset Current with time, Common-Mode Configuration and Common-Mode Rejection Ratio.

Unit II: Frequency Response of OP-Amp **15 hours**

Introduction, Block Diagram Representation of Feedback Configurations, Voltage-Series Feedback Amplifier, Voltage Shunt Feedback Amplifier, Differential Amplifiers, **PSPICE Simulation:** Introduction, Frequency Response, Compensating Networks, Frequency Response of Internally Compensated Op-Amps, Frequency Response of Non-compensated Op-Amps, High Frequency Op-Amp Equivalent Circuit, Open Loop Voltage Gain as a Function of Frequency, Closed Loop Frequency Response, Circuit Stability, Slew Rate

Unit III: Applications of Op-Amp (Part-I) 15 hours

Introduction, DC and AC Amplifiers, AC Amplifiers with a Single Supply Voltage, The Peaking Amplifier, Summing, Scaling, and Averaging Amplifier, Instrumental Amplifier, Differential Input and Differential Output Amplifier, Voltage to Current Converter , Current to Voltage Converter, Very High Input Impedance Circuit, The Integrator, The Differentiator, **PSPICE Simulation:** Active Filters, First-Order Low-Pass Butterworth Filter, Second-Order Low Pass Butterworth Filter, First-Order High Pass Butterworth Filter, Second Order High Pass Butterworth Filter, Higher Order Filters, Band-Pass Filters, Band- Reject Filters, All-Pass Filters,

Unit IV: Applications of Op-Amp (Part-II) 15 hours

Introduction, Basic Comparator, Zero-Crossing Detector, Schmitt Trigger, Comparator Characteristics, Limitations of Op-Amp as Comparator, Voltage Limiters, Window Detector, Voltage to Frequency and Frequency to Voltage Converters, Analog to Digital and Digital to Analog Converters, Clippers and Clampers, Peak Detector, Sample and Hold Circuit.

Reference

1. Electronics devices and circuits J.B. Gupta, S.K. Kataria and Katson publication, New Delhi
2. Operational Amplifiers with Linear Integrated Circuits"Stanley, Pearson Education.
3. Op-Amps and Linear Integrated Circuits"Gayakwad,Pearson Education.
4. Active and passive analog filter design An Introduction, Lawrence P. Huelsman McGraw-Hill, Inc
5. Design with operational Amplifier and Analog Integrated Circuits, Sergio Franco, TATA McGraw-Hill

ELE 203- VHDL

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I: Programmable Logic Devices **15 hours**

Programmable Logic Devices, Introduction, Evolution: PROM, PLA, PAL, Architecture of PAL's Applications, Programming PLD's. Design Flow, Programmable Interconnections, FPGA,CPLD

Unit II: Introduction to HDL **15 hours**

Introduction to HDL Importance and evolution of hardware description languages (HDL) and VHDL Capabilities hardware abstraction, Using VHDL: Basic terminology-design entity declaration-architecture body-configuration declaration-package declaration package body. Basic Language Elements Identifiers and keywords-Escaped identifiers, Data Objects: Constants-Variables-Signal- File, Data Types: Scalar-Composite-Access-File, Operators: Logical-Relational-Shift- Adding Multiplying-Miscellaneous

Unit III: Synthesis Using VHDL **15 hours**

Introduction. Behavioral, Data flow, Structural Models. Simulation Cycles. Process. Concurrent Statements. Sequential Statements. Loops. Delay Models. Sequential Circuits, FSM Coding. Library, Packages. Functions, Procedures. Operator Inferencing. Test bench. Programmable Logic Devices FPGA, CPLD: Features and applications

Unit IV: Applications of VHDL **15 hours**

Packages, libraries and Features: Package Declaration-Package Body-Design Libraries-Design File-Order of Analysis- Implicit Visibility-Explicit Visibility, Model Simulation: Test Bench-Creation-Converting real and integer to time-Test bench example-Initializing a memory-variable file names, Simulation examples- Gates, flip-flops, multiplexer - demultiplexer, shift register, ring counter, decade counter, synchronous counter, adder, multiplier.

References:

1. Jon F Wakerly, Digital Design: Principles and Practices, Prentice Hall.
2. Kevin Skahil, VHDL for programmable logic, Addison Wesley.
3. Zainalabedin Navabi, VHDL, analysis and modeling of digital systems, McGraw-Hill.
4. PLD, FPGA data sheets.

ELE 204 A- Power Electronics (Elective)

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I: Introduction to Power Electronics **15 hours**

Power semiconductor devices: Power diodes, thyristors, power MOSFETs, power transistors, IGBT, Thyristor firing circuits: Limitations of di/dt and dv/dt ratings, main features of firing circuits, R and RC firing circuits, UJT firing circuit. Commutation Techniques

Unit II: **Phase Controlled Rectifiers** **15 hours**

Single phase half wave rectifiers: with R load, RL load, RL load with freewheeling diode, RLE load. Single phase full wave converters: Single phase semi converters, single phase two pulse converters with continuous and discontinuous current. Three-phase converter: System using diodes and thyristors, three-phase full converters, three phase semi converters, dual converters.

Unit III: Voltage Controllers **15 hours**

AC Voltage controllers: Types of AC voltage controllers, integral cycle control, single phase voltage controllers, with R and RL loads, single-phase sinusoidal voltage controllers, working of three-phase controllers with star & delta loads. Cycloconverters: Principle of cycloconverter operation, single-phase to single-phase circuit, step-up and step-down cycloconverter.

Unit IV: Inverters and Choppers **15 hours**

Inverters: Principle of operation, single-phase voltage source inverters, basic series and parallel inverter circuits, types of inverters, three-phase bridge inverters, voltage control in single-phase inverters, pulse-width modulated inverters, current source inverters. Choppers: Basic principle, control strategies, step-up and step-down choppers, types of chopper circuits, Switching-mode regulators- buck regulators, boost regulators, buck-boost regulators, cuk regulators.

References:

1. Power Electronics: Bimbhra P S, Khanna Publishers, 2003.
2. Power Electronics Circuit devices and applications: Rashid M H, PHI.
3. Thyristor Engineering: Berde, M S Khanna publishers.
4. Power Electronics: Vedam Subrahmanyam, New Age International, 2002.
5. Modern Power Electronics and AC Drives: Bimal K Bose, Pearson Education, 2002.
6. Power Electronics: Mohan, Undeland, Robbins, John Wiley, 2003.

ELE 204 B- Mechatronics (Elective)

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I: Introduction to Mechatronics **15 hours**

What is mechatronics, an overview of - the design process, various systems in mechatronics such as embedded systems, modeling systems, measurement systems, control systems, examples of mechatronic systems Sensors and Transducers: Introduction to sensors and transducers, sensitivity analysis, effect of component variation, measurement of motion, digital sensors for motion measurement, force, torque and tactile sensors, vibration- acceleration sensors, flow measurement, temperature sensors and devices, applications of sensors

Unit II: Mechanical Actuation Systems **15 hours**

Mechanical actuation systems: mechanisms and their role in mechatronic systems, translational and rotational motion – degrees of freedom, kinematic chains – examples of links, toggle linkage, slider-crank etc. cams, gears – types, gear trains, gear ratios, uses of rotation-to-translational motion – rack and pinion, ball screw and links, Ratchet and pawl, belt and chain drives,

Unit III: Basic System Models **15 hours**

Mechanical (translational and rotational) system building blocks, electrical system building blocks, electrical and mechanical analogies and their use in analysis, basic idea of fluid system building blocks and thermal system building blocks System models- Engineering system models, rotational-translational systems, electromechanical systems, linearity

Unit IV: Artificial intelligence **15 hours**

Artificial intelligence-basic ideas, meaning, perception and cognition, reasoning and learning Communication Systems- meaning of centralized hierarchical and distributed control. Parallel and serial data transmission, modes of serial data transmission, types of networks and methods of network access control Meaning of and basic elements of protocols, open systems interconnection communication model, serial communication interfaces, parallel communication interfaces, wireless protocols.

References:

1. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering by William Bolton, 6th Ed., Pearson Publication
2. Robotics Engineering – An integrated approach. By Richard W. Klafter, Thomas A. Chmielewski and Michael Negin, PHI Learning Pvt. Ltd.

ELE 301-: Industrial Process Control

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I: Fundamentals of Process Control **15 hours**

Closed loop control and functional elements in it open-loop control, continuous and discrete state control, control strategies such as feedback, feed forward and adaptive control, steady state optional control concept of DCS, evolution of process control,

Unit II: Introduction to Control System **15 hours**

Mathematical models of systems, concept of transfer function and its use, method of obtaining transfer function, block diagram of control system, rules of block diagram reductions and examples thereof. Concept of stability, Routh stability criterion, Roth- Hurwitz criterion, Root locus steps in drawing root locus, Use of root locus and examples thereof. Frequency response methods of control system analysis, Bode-plots method to plot and examples thereof, Nyquist plots, method to plot and examples

Unit III: Introduction to Process Controllers **15 hours**

Classification of controllers, Controller terms Discontinuous controllers: On-OFF Controller, three position controller Continuous controllers: Proportional, Integral and Derivative control Composite control modes: PI, PD and PID controllers. Derivative overrun and integral windup in PID control mode Design of analog controller circuits for above modes characteristics and applications DCS hardware and software

Unit IV: Applications of Process Controllers **15 hours**

Principle and characteristics of control values, synchro-servo motors, Solenoids, actuators, annunciators, alarms, recorders, Standard Graphics Symbols for Process Control and Instrumentation Control system examples: Speed control system, position control systems, temperature and level control systems, reel drives, tension control system for paper

References:

1. Process Control Instrumentation Technology, Curtis D. Johnson, Eighth Edition, (2008)
2. Control System-I, U.A. Bakshi, V.U. Bakshi, Technical Publications, 3rd Edition, (2012)
3. Programmable Logic Controllers, W. Bolton,4th Edition, 2006
4. Practical SCADA for Industry David Bailey BEng, Bailey and Associates, Perth, Australia (2003)

ELE 302 - Network Analysis and Synthesis

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [MSA: 25 (T1+T2+HA); ESA=75]

Unit I: Introduction to Network Theorem **15 hours**

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

Unit II: Network Analysis **15 hours**

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

Unit III: Laplace Transform for Circuit Analysis **15 hours**

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.

Unit IV: Network Parameters **15 hours**

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, interconnection of two port networks.

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.

ELE 303 - Python Programming for Electronics

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I: Basics of Python **15 hours**

Python Basics Python installation and scripts – IDLE, Interactive sessions – basic syntax – Writing and executing simple program – Basic data types, declaring variables – Operators – Conditional Statements – Looping and Control statements – Lists – Tuples – Sets – Dictionaries

Unit II: **Functions in python** **15 hours**

Functions, Modules Functions: Defining a function – Calling a function – Types of functions – Function Arguments – Anonymous functions – Global and local variables Modules: Importing modules – Packages – Custom modules

Unit III: File Format **15 hours**

Files and Exception Files: Reading and writing binary data – Reading and Parsing text files – Reading and parsing xml files – format operator; command line arguments Exception: Errors and exceptions – handling exceptions – except clause – Try? Finally, clause – user defined exceptions

Unit IV: GUI Programming **15 hours**

GUI Programming (using Tkinter and Qt) Using Tkinter: GUI and its advantages – GUI Library – Grid layout – call-backs and event binding – Creating widgets with Tkinter/Qt such as Frame, Label, Button, Checkbox, Entry, List-box, Dialog boxes, Radio-button, Text, Canvas, Bitmap graphics Using Qt: Setting up code base, Building UI with Qt designer – Writing the UI – Launching the UI – packaging the code Database connectivity and Internet Programming Database Access: Python's Database Connectivity – Types of Databases used with Python

Reference:

1. Mark Summerfield, "Programming in Python 3: A Complete Introduction to the Python Language ", Pearson Education India/Addison Wesley, 2018(2nd Edition), ISBN: 9789352869176
2. Paul Gries, Jennifer Campbell, Jason Montojo, "Practical Programming: An Introduction to Computer Science Using Python 3.6", The Progmatic Bookshelf U.S., 2017(3rd Edition),
3. Allen B. Downey, "Think Python", O'Reilly U.S./Green Tea Press (Online Publishers), 2nd Edition

ELE 304 A- Virtual Instrumentation & Programming in Lab VIEW(Elective)

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I: Introduction to Virtual Instrument **15 hours**

Traditional instruments: basic block diagram, disadvantages; Virtual instruments: basic block diagram (architecture), advantages, applications; text based programming language; graphical programming language; Lab VIEW programming concepts: data flow, polymorphism; introduction to LabVIEW: advantages, front panel window, block diagram windows, icon/connector pane, palettes, data types

Unit II: Lab VIEW Programming **15 hours**

Modular programming: build a VI front panel & block diagram, icon and connector pane, creating sub VI; repetition and loops: *for* loop, *while* loop, shift registers, feedback nodes; control timing, communicating among multiple loops, local and global variables; array: one dimensional, two dimensional, multidimensional, array control, array indicators, array constants; cluster: creating cluster control, creating cluster indicators, order of cluster elements, assembling clusters, disassembling clusters, conversion between arrays and clusters, error handling, error cluster;

Unit III: Instrument Control **15 hours**

Plotting data: types of waveforms, graphs, charts and their types; structures: case, sequence, timed, events, formula nodes, math script; strings and file I/o; creating string controls and indicators, string function, formatting strings, basics of file I/o, choosing a file I/o format. Instrument control: Instrument I/o Assistant, VISA, instrument drivers, serial port communication, serial port standard RS-232; other interfaces: GPIB, USB, firewire, IEEE-1394 controllers and ethernet

Unit IV: Processing and Tool Kits **15 hours**

Processing and Tool Kits in Lab VIEWIMAQ vision: vision basics, image processing and analysis, particle analysis, machine vision, machine vision application areas; motion control: components of motion control system, motion controller, move type, motor amplifiers and drivers, motor fundamentals; Control design and simulation tools: Design of temperature and pressure controller using PID controller, light intensity measurement system, digital filter design and modulation tool kits, simulation of ECG signal, power spectrum analysis, FFT analysis, wavelet transform.

References:

1. Virtual Instrumentation using Lab VIEW : Jovitha Jerome, PHI Learning Pvt. Ltd., New Delhi
2. Virtual Instrumentation using Lab VIEW : Sanjay Gupta and Joseph John, TMH, New Delhi\
3. Lab VIEW for Everyone: Jeffrey Travis and Jim Kring, Pearson Education, New Delhi
4. NI Lab VIEW user manual

ELE 304 B - Signal & System (Elective)

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I: Introduction to Signal & Systems **15 hours**

Definitions of a signal, classification of signals, basic operations on signals, elementary signals, discrete time signals, sampling process and Nyquist rate. Definition of a system, systems viewed as interconnections of operations, properties of systems.

Unit II: Time-domain Representations for LTI systems **15 hours**

Convolution integral and convolution sum and their properties, properties of LTI systems, impulse and step response, differential and difference equation representations and their block diagram representations.

Unit III: Fourier Series Representation for Signals **15 hours**

Introduction, discrete time and continuous time Fourier series and their properties, problems. Discrete and continuous time Fourier transforms and their properties. parseval's relationship, time bandwidth product, duality property.

Unit IV: Laplace Transform **15 hours**

The Laplace transform, unilateral Laplace transform and its inversion, properties, solving differential equations, properties of bilateral Laplace transform and ROC, inversion of bilateral Laplace transform, analysis of LTI systems using Laplace transforms, transfer function, causality and stability, frequency response from poles and zeros.

References:

1. Signals and Systems: Simon Haykin, Barry Van Veen, John Wiley India, 2ndEdn, 2008.
2. Signals and systems: Alan V Oppenheim, Alan SWillsky and Hamid Nawab, ,PHI, 2nd edition, 2002.

ELE 401 -Programmable Logic Controller

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I: Architecture of PLC **15 hours**

PLC hardware, Types of PLC, CPU unit architecture, The I/O section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O specifications, The CPU, Memory design, Memory Types, Programming Devices, Selection of wire types and size. Memory classification, Input/output devices and it's interfacing, Digital-Analog modules, Communication modules, Special function modules.

Unit II: PLC Programming-I **15 hours**

Timers programming, Counter programming PLC INSTRUCTIONS Bit Logic Instructions: NO, NC, Set, Reset, rising edge Pulse, Falling Edge Pulse, RS, SR, NOP, OUTPUT etc. Clock: READ RTC, SET_RTC. Different Logical operation Instructions: Different Integer Math Instructions: Addition, Subtraction, Multiplication, Division, Increment, Decrement- Integer, Different Conversion Instructions: Byte – Integer, Integer To Byte, Integer To Double Integer,

Unit III: PLC Programming-II **15 hours**

Processor Memory Organization, Program Scan, PLC Programming languages, Relay type instructions, Instruction addressing, Branch Instructions, Internal Relay Instructions, Programming Examine if Closed and examine If Open instructions, Entering the ladder diagram, Modes of operation. Creating Ladder Diagrams from Process Control Descriptions. Ladder diagram & sequence listing; large process ladder diagram construction, flow charting as programming method, Industrial Examples,

Unit IV: PLC operation **15 hours**

Various INPUT /OUTPUT Devices and its interfacing with PLC.

Different types of Input devices : Switches: Push button Switches, Toggle Switches, Proximity switches, Photo switches, Temperature Switch, Pressure Switch, and Level Switch,Flow Switches,

manually operated switches, Motor starters, Transducers and sensors, Transmitters etc. Their working, specification and interfacing with PLC. Different types of Output devices : Electromagnetic Control Relays, Latching relays, Contactors, Motors, Pumps, Solenoid Valves etc. Their working, specification and interfacing with PLC.

References:

1. Programmable logic controller by Frank D. Petrusella, Tata McGraw-Hill publication
2. Introduction to programmable logic controller by Gary dunning, Thomson Asia Pte Ltd. Publication, Singapore
3. Programmable Logic Controllers: Principles and Applications by John W. Webb and Ronald A. Reis, Prentice – Hall India publication, 5th edition
4. Programmable Logic Controllers by W. Bolton, Elsevier Newnes publication, 4th edition
5. Programmable Controllers An engineer's guide by E.A.Parr, Elsevier Newnes publication 3rd edition

ELE 402 – Measurement & Instrumentation

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I: Introduction to Transducers **15 hours**

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

Unit II: Measurement of Physical Quantities **15 hours**

Measurement of different physical parameters and their sensors and transducers of displacement, velocity, acceleration, force, torque, strain, temperature, pressure, flow, humidity, thickness, pH

Unit III: Measuring Equipments **15 hours**

Measuring Equipment -Measurement of R, L and C, Bridge and potentiometer, voltage, current, power, energy, frequency/time, phase, Digital Multi meters, CRO, Digital Storage Oscilloscope, Spectrum Analyzer

Unit IV: Biomedical Instruments **15 hours**

Biomedical Instruments- ECG, EEG, Blood Pressure Measurements, MEMS and its applications Sensors for IoT applications.

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).

ELE 403- Advance Embedded System

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I: Overview of PIC controllers **15 hours**

Overview of PIC Micro controllers, Introduction to PIC micro controllers -Advantage of PIC micro controllers –Types and products of PIC. Comparison between 8051 and PIC micro controller, architecture of PIC, Introduction to MPLAB & Micro C.

Unit II: Architecture of PIC 16 **15 hours**

Introduction to PIC16, Pin diagram, Pic 16 family overview, Architecture of Pic 16, Basic I/O programming using C, Timer Programming, sensor interface using ADC . Proximity sensor interfacing: IR , Ultrasonic sensor. LED Blinking

Unit III: Introduction of Raspberry Pi platform **15 hours**

Introduction of Raspberry Pi 3, Raspberry Pi 3 Hardware. Raspberry Pi 3 OS, prepare sd card for PI , Powering Up and Running. Connecting to a Network. Raspberry Pi Programming method

Unit IV: Raspberry Pi Programming **15 hours**

Programming the Raspberry Pi ,Compiling C Programs · Wiring Pi Library-Installation · Using Wiring Pi for GPIO Programming · LCD (16*2) Interfacing to pi · Study GPIO Pins, Configuring GPIO Pins, Python programming on Pi ,basic GPIO program Using Python

References:

1. Programming the Raspberry Pi, 2nd Edition: Getting Started with Python.
2. Exploring Raspberry Pi: Interfacing Real World with Embedded Linux.
3. Raspberry Pi For Kids-Dummies.
4. Raspberry Pi Electronic Projects for Evil Genius.

ELE 404 A- Digital Image Processing(Elective)

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I : Basic Components of Image Processing **15 hours**

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

Unit II: Image Enhancement **15 hours**

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 function, inverse filtering

Unit III: Image Processing and segmentation **15 hours**

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; Image Segmentation: fundamentals, edge-based segmentation; image thresholding, intensity thresholding; basic global thresholding, multi-variable thresholding

Unit IV: Image Compression and Watermarking **15 hours**

Image compression and Digital Image Watermarking Pixel and data redundancy, fidelity criteria, image compression models; Image file formats and compression standards, BMP, GIF, TIFF, JPEG, CDR; types of compression, lossless coding techniques, LZW coding, Lossy transform coding, DCT. Wavelet coding, discrete wavelet transform, Haar wavelets, digital image watermarking, need for image watermarking; visible and invisible watermarks, a typical watermarking system, water mark insertion and extraction methods

Reference :

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

6. Soman K. P. and Ramachandran K. I., Wavelet Transform: From Theory to Practice, PHI, 2008

ELE 404 B -Introduction to Java (Elective)

Credits: 04	Contact Hours: 60 Hrs (L+T+R)	Total Marks: 100 [CA: 25 (T1+T2+HA); ESA=75]

Unit I: Overview of Java language **15 hours**

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: Documentation section Package statement-Import statement-Interface statement-Class definitions-Java keywords.

Unit II: Data types and Variables of Java **15 hours**

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.

Unit III: Object Oriented Programming **15 hours**

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. Inheritance: Types of inheritance-Extending a class-Super class-Multilevel inheritance- final and abstract keyword Overriding Methods, Interfaces: Implementing interfaces, Accessing interface variable.

Unit IV: Multi-threaded Programming **15 hours**

Multi threaded Programming: Creating threads-Extending the thread class-Stopping and blocking a thread-Life cycle of a thread-Using thread methods-thread exceptions-thread priority Synchronization, Java Packages: Java API packages-Using system package- Naming conventions-creating package-accessing package-Using package-adding a class to package hiding classes-Static import.

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.

ELE 106-Laboratory Course -I

Credits: 04	**Contact Hours: 60 Hrs (Hands On)**	**Total Marks: 100** **[CA=25(Test+Viva+Journal), ESA=75]**

At least 12 experiments (6 from each group) be completed by a student.

(Based on Semiconductor Devices)

1. Study of V-I Characteristics of a Diode.
2. Study of V-I Characteristics of a Photo Diode.
3. Study of Hall effect
4. To study zener diode characteristics.
5. To study zener diode as voltage regulator.
6. To study and draw the characteristics of FET in common source configuration.
7. To plot and study the input and output characteristics of BJT in common-emitter configuration.

(Based on Fiber Optics Communication)

1. Measurement of NA of a multi mode fiber.
2. Measurement of Mode field diameter of a single mode fiber.
3. Measurement of Dispersion of optical fiber.
4. Performance of PAM on fiber optic link.
5. Performance of PWM on fiber optic link.
6. Performance of PPM on fiber optic link.
7. Measurement of attenuation with OTDR.
8. Measurement of emission wavelength of LED/LASER

ELE 107-Laboratory Course -II

Credits: 04	Contact Hours: 60 Hrs (Hands On)	Total Marks: 100 [CA=25(Test+Viva+Journal), ESA=75]

At least 12 experiments (6 from each group) be completed by a student.

(Based on Digital Logic Design)

1. To design and test adder circuits using XOR gate.
2. To design and build BCD-to-7 segment converter
3. To design and test A 4-bit binary parallel adder.
4. BCD TO EXCESS- 3 Code Converter
5. To design and set up a 4:1 Multiplexer (MUX)
6. To realize One- & Two-Bit Comparator and study of 7485 magnitude comparator.
7. Truth Table verification of 1) RS, JK, T, D Flip Flop 2
8. To realize and study of Shift Register. 1) SISO 2) SIPO) 3) PIPO 4) PISO
9. To realize and study Ring Counter and Johnson counter.
10. To design and test 3-bit binary synchronous counter using flip-flop IC 7476 for the given sequence.

(Based on Python Programming)

1. Running instructions in Interactive interpreter and a Python Script
2. Write a program to compute distance between two points taking input from the user
3. (Pythagorean Theorem)
4. Write a Program for checking whether the given number is a even number or not.
5. Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.
6. Write a program to compute the number of characters, words and lines in a file.
7. Find mean, median, mode for the given set of numbers in a list.
8. Write a script that imports requests and fetch content from the page. Eg. (Wiki)
9. Write a GUI for an Expression Calculator using tk
10. Write a test-case to check the even numbers

ELE 206-Laboratory Course -III

Credits: 04	Contact Hours: 60 Hrs (Hands On)	Total Marks: 100 [CA=25(Test+Viva+Journal), ESA=75]

At least 12 experiments (6 from each group) be completed by a student.

(Based on Microcontroller and Interfacing)

1. Write a embedded C program for basic mathematical operation for 8051 i.e., addition, subtraction, division, multiplication.
2. Write a embedded C program for basic logical operation for 8051
3. Write program to interface Led with 8051
4. Study of interfacing of Seven segment display
5. Study of interfacing the LCD 16 x 2 with 8051
6. Write the program to transfer and receive the data using serial protocol
7. Study of interfacing of dc motor and control its direction of rotation.
8. Study of PWM generation of different frequency
9. Write the program to interface temperature sensor with 8051 by using ADC controller
10. Write the program to interface the 4 x 4 keypad with 8051

(Based on Op-Amp and its applications)

1. Performance evolution of a summing amplifier circuit.
2. Implement an integrator circuit using op-amp.
3. Study an op-amp based differentiator circuit.
4. Zero crossing detector using op-amp .
5. op-amp based Active Low pass filter
6. Second order high pass filter using op-amp
7. clipper and clamper circuit using op amp
8. Precision Rectifiers.

ELE 207 -Laboratory course- IV

Credits: 04	Contact Hours: 60 Hrs (Hands On)	Total Marks: 100 [CA=25(Test+Viva+Journal), ESA=75]

At least 12 experiments (6 from each group) be completed by a student.

(Based on Advanced Digital System Design)

1. Write the VHDL/verilog Program to test Logic Gates
2. Write the VHDL/ verilog Program to test Logic Gates Adder, Subtractor
3. Write the VHDL/ verilog Program to test Logic Gates Code converters
4. (a) BCD to Excess-3 converter
5. (b) Binary to Gray converter
6. (c) Gray to Binary. converter
7. Write the VHDL/ verilog Program to test Logic Gates Flip – Flops - RS, JK D & T.
8. Write the VHDL / verilog Program to test Logic Gates 4- bit ALU.
9. Digital System Design Experiments based on CLPD kits
10. Digital System Design Experiments based on FPGA

(Based on Power Electronics)

1. To obtain the V-I characteristics of SCR (Silicon Controlled Rectifier).
2. To obtain the V-I characteristics of TRIAC for both forward and reverse biased conduction
3. To study triggering of (i) IGBT (ii) MOSFET (iii) power transistor
4. To study single phase cyclo-converter
5. To study operation of IGBT/MOSFET chopper circuit
6. To study single-phase ac voltage regulator with resistive and inductive loads.
7. UJT triggering Circuit
8. Ac voltage control by TRIAC and DIAC
9. Speed Control of Inductive motor
10. Digital Firing Circuit

ELE 306 -Laboratory course- V

Credits: 04	Contact Hours: 60 Hrs (Hands On)	Total Marks: 100 [CA=25(Test+Viva+Journal), ESA=75]

At least 12 experiments be completed by a student for each lab course.

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. Transmission and hybrid parameters
5. Write the program for Arduino uno to display 0 to 9 numbers on seven segment display
6. Write a program for Arduino to design LDR based light control
7. Write the program for Arduino uno to interface the proximity sensors
8. Write the program for Arduino uno to display temperature on 16X2 LCD
9. Write the program To interface the servo and dc motors with Arduino mega
10. Write the program to interface touch screen with Arduino Mega
11. Write the program to transfer and receive the data using different communication protocols i.e . serial, I2C , SPI
12. Write the program to transfer the data using RF communication
13. Data acquisition using virtual instrumentation from temperature transducer
14. Data acquisition using virtual instrumentation from pressure transducer
15. Stepper motor control using virtual instrument
16. Study of PI, PID Controller
17. Locus Diagrams of RL and RC Series Circuits
18. Simulation of DC Circuits
19. Reciprocity and Millmann's Theorems
20. Characteristics of I/P and P/I converters

ELE 307 -Laboratory course- VI

Credits: 04	Contact Hours: 60 Hrs (Hands On)	Total Marks: 100 [CA=25(Test+Viva+Journal), ESA=75]

At least 12 experiments be completed by a student for each lab course.

1. Study of some discrete- time signals
2. Design and study of some FIR filters
3. Study of triangular and Blackman windows
4. Design of FIR filters using windowing technique
5. Design of filters based on pole-zero placements
6. Introduction to Software Tools MPLAB, PROTEUS, and PIC programmer.
7. Some Logic Functions Design using PIC 16
8. Write the program for PIC16 to create delay using Timer Register
9. Study of implementation of DC Motor control using PWM method
10. Write the program to Transmission and Reception of data through serial port using PIC 16
11. Write the program to blink LED using PIC 12
12. Write the program for PIC 12 to rotate dc motor clockwise and anticlockwise using Button
13. Write the program to interface Bluetooth with Pi and send the data to smart phone
14. Write the program to control the dc motor using smart phone
15. Design smart home automation system using raspberry Pi
16. Automatic indication of water tank level using PLC
17. Study of Traffic lights indication using PLC
18. Study of Logic Gates using PLC
19. Forward and Reverse direction control of Motors using PLC
20. Calibration of thermocouple/ for temperature measurement.
21. Study and calibration of a rotameter for flow measurement.

ELE 406 - Project

M. Sc.-II (Electronics)/Semester IV students will have project of 200 marks.

The Projects will be evaluated at the time of final examination, jointly by the external and internal examiners, by conducting viva and demonstration of the project work.

[Note:- Not more than 6 to 8 projects be evaluated by a single external examiner]

A copy of the project work be made available to the external examiner at least a day before the actual date of examination.

GUIDELINES FOR PROJECTS:

1. The Project experiment should be open ended
2. It may be based on any topics of the syllabus
3. It may be based on collection of data and then analysis leading to some meaningful conclusion
4. It may be based on review of a suitable research topic
5. It may be based on development of a new idea and design/fabrications
6. It may consist of hardware and software

PRESENTATION OF THE PROJECT:

Actual presentation format of the project may be decided by the teacher and the student. However, the following guidelines are given for general consideration.

1. At least four copies of the project be submitted.
2. It should be typed on sunlit bond A4 paper, single side with one and half/double - spacing.
3. The project should be of 30 to 40 pages.
4. It should be duly certified by the project supervisor and countersigned by the Head of the Department.
5. The project record should include information under the following/suitable heads:

(a) Introduction
(b) Theory (Related to the project)
(c) Experimental details
(d) Observations and Graphs, if any
(e) Results and discussion
(f) References