॥ 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

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

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

Fax : (02462) 215572

Academic-1 (BOS) Section

website: srtmun.ac.in

Phone: (02462)215542

E-mail: bos@srtmun.ac.in

शैक्षणिक वर्ष २०२६–२७ पासून राष्ट्रीय शैक्षणिक धोरणानुसार लागू केलेल्या विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी तृतीय वर्षाचा सुधारित (दुरूस्ती) अभ्यासक्रमाबाबत.

प रि प त्र क

संदर्भ : १) शै–१/परिपत्रक/पदवी/बीएस्सी/२०२६–२७/६० दि.१९.०६.२०२६

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, संदर्भीय परिपत्रकान्वये दिनांक २२ एप्रिल २०२६ रोजी संपन्न झालेल्या मा.विद्या परिषद बैठकीतील विषय क्र.०८/६४–२०२६ अन्वये मान्यता दिल्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरणानुसार पदवी तृतीय वर्षाचे अभ्यासक्रम शैक्षणिक वर्ष २०२६–२७ पासून लागू करण्यात आलेले आहेत.

तथापि, वरील संदर्भीय परिपत्रकान्वये प्रकाशित केलेल्या अभ्यासक्रमामध्ये अभ्यास मंडळ अध्यक्षांनी किरकोळ दुरूस्ती करून अभ्यासक्रम सादर केला असून,मा.अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा यांच्या मान्यतेने दुरूस्ती केलेला खालील सुधारित अभ्यासक्रम (Syllabus) लागू करण्यात येत आहे.

01	**B.Sc. III Year Electronics (Affiliated Colleges)**

सदरील परिपत्रक व अभ्यासक्रम (Syllabus) 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/परिपत्रक/पदवी/सुधारित/२०२६–२७/132
दिनांक : ०८.०८.२०२६

उपकुलसचिव
शैक्षणिक (१–अभ्यास मंडळे) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :–
१) मा. कुलगुरू महोदयांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. प्र.कुलगुरू महोदयांचे कार्यालय, प्रस्तुत विद्यापीठ
३) मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा,प्रस्तुत विद्यापीठ.
४) मा. संचालक, परिक्षा व मूल्यमापन मंडळ, प्रस्तुत विद्यापीठ.
५) मा. प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
६) सिस्टीम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. यांना देवून कळविण्यात येते की, परिपत्रक अभ्यासक्रम संकेतस्थळावर प्रसिध्द करण्यात यावेत.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,

- NANDED - 431 606 (MS) -

(Credit Framework and Structure of Four Year UG Program with Multiple Entry and Exit Option as per NEP-2020)

SYLLABUS

of

UNDERGRADUATE PROGRAMME OF
SCIENCE & TECHNOLOGY

B.Sc. Third Year

Major in Electronics

Under the Faculty of Science & Technology

(Revised as per the Govt. Of Maharashtra circular Dt. 13th March 2024)

Effective from the Academic year 2026 - 2027

(As per NEP-2020)

Details of the Board of Studies Members in the subject Electronics under the faculty of Science & Technology of S.R.T.M. University, Nanded

Sr No	*Name of the Member*	*Designation*	*Address*	*Contact No.*
1	Prof. Y S Joshi	Chairman	Lal Bahadur Shastri Mahavidyalaya, Dharmabad	9405362172
2	Prof. S M Yenorkar	Member	Shri Shivaji College Parbhani	7276532176
3	Dr S K Gore	Member	Dnyanopasak Mahavidyalya, Jintur	9422879596
4	Dr D B Suryawanshi	Member	Shri Havgiswami College, Udgir	9423307098
5	Dr R S Kawale	Member	Dnyanopasak Mahavidyalya, Jintur	9545231648
6	Prof. I G Shere	Member	Shri Havgiswami College, Udgir	8329792082
7	Prof. A V Sarode	Member	School of Physical Sciences, SRTMU Nanded	9921340727
8	Prof. Vikas Baburao Patil	Member	Punyashlok Ahilyadevi Holkar Solapur University, Solapur	9422532521
9	Prof. Girish Mukundrao Joshi	Member	Institute of Chemical Technology (ICT), Mumbai Marathwada Campus, Jalna	8838660102
10	Prof. R L Raibagkar	Member	Deptt. of Physics, Gulbarga University, Kalburgi	9739302083
11	Shri Jagdish Arun Deshmukh	Member	Cermet Resistronics, Pvt. Ltd. Pune	9623371844
12	Shri Arun Pandit Potdar	Member	Micromax Instruments Pvt. Ltd. Pune	9822061328
13	Miss. Shruti Mahesh Tiwari	Invitee Member (UG Student)	Lal Bahadur Shastri Mahavidyalaya, Dharmabad	--
14	Shrise Sayantra Maroti	Invitee Member (PG Student)	Yeshwant Mahavidyalaya, Nanded	--

Invitees for this Meeting				
15	Dr A G Chawhan	Invitee Member	Lal Bahadur Shastri Mahavidyalaya, Dharmabad	9421757130
16	Dr Y T Nakate	Invitee Member	Yeshwant Mahavidyalaya, Nanded	8007739619
17	Shri S R Dulewad	Invitee Member	Science College, Nanded	7709728100
18	Dr T H Mujawar	Invitee Member	Dayanand Science College, Latur	9130366590

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology (Three Optional in the First Year)

Credit Framework for Four Year Multidisciplinary Degree Program with Multiple Entry and Exit

Subject: ELE (Major) /DSM (Minor 1 and Minor 2)

(For illustration PHY, CHE and ELE combinations are considered, which may change for different combinations)

Year & Level	Semester	Optional 1 (Major) *(From the same Faculty)*		Optional 2 (Minor 1) *(From the same Faculty)*	Optional 3 (Minor 2) *(From the same Faculty)*	Generic Elective (GE) (select from Basket 3 of *Faculties other than Science and Technology*)	Vocational & Skill Enhancement Course	Ability Enhancement Course (AEC) (Basket 4) Value Education Courses (VEC) / Indian Knowledge System (IKS) (Basket 5) *(Common across all faculties)*	Field Work / Project/Internship/ OJT/ Apprenticeship / Case Study Or Co-curricular Courses (CCC) (Basket 6 for CCC) *(Common across all faculties)*	Credits	Total Credits
1	2	3		4	5	6	7	8	9	10	11
3 (5.5)	V	SELECT1301 (3cr) SELECP1301 (2cr) SELECT1302 (3cr) SELECP1302 (2cr) SELEIKS1301 (2cr) 12 Credits	SELEET1301 (2cr) OR SELEET1302 (2cr) SELEEP1301 (2cr) OR SELEEP1302 (2cr) 4 Credits	--	--	--	VSC 3 SELEVC1301 2 Credits	--	FP1 (4Cr) (FP/CS) SELEFP1301 4 Credits	22	132
	VI	SELECT1351 (3cr) SELECP1351 (2cr) SELECT1352 (3cr) SELECP1352 (2cr) SELECT1353 (2cr) 12 Credits	SELEET1351 (2cr) OR SELEET1352 (2cr) SELEEP1351 (2cr) OR SELEEP1352 (2cr) 4 Credits	--	--	--	VSC 4 SELEVC1351 2 Credits	--	OJT SELEOJT1351 4 Credits	22	
Cum. Cr.		56		16	08	08	12	22	10		

Abbreviations:

1. **DSC:** Department/Discipline Specific Core (Major)
2. **DSE:** Department/Discipline Specific Elective (Major)
3. **DSM:** Discipline Specific Minor
4. **GE/OE:** Generic/Open Elective
5. **VSEC:** Vocational Skill and Skill Enhancement Course
6. **VSC:** Vocational Skill Courses
7. **SEC:** Skill Enhancement Courses
8. **AEC:** Ability Enhancement courses
9. **MIL:** Modern Indian languages
10. **IKS:** Indian Knowledge System
11. **VEC:** Value Education Courses
12. **OJT:** On Job Training: (Internship/Apprenticeship)
13. **FP:** Field Projects
14. **CEP:** Community Engagement and Service
15. **CC:** Co-Curricular Courses
16. **RM:** Research Methodology
17. **RP:** Research Project/Dissertation

B. Sc. Third Year Semester V *(Level 5.5)*

Teaching Scheme

Subject	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	SELECT1301	Analog Communication	03	--	**03**	03	--
	SELECP1301	Practical Based on SELECT1301	-	02	**02**	--	04
	SELECT1302	Power Electronics	03	--	**03**	03	--
	SELECP1302	Practical Based on SELECT1302	-	02	**02**	--	04
	SELEIKS1301	Evolution of Electronic Communication Systems in India	02	--	**02**	02	--
Elective	SELEET1301 OR SELEET1302	Embedded System Design OR Nanotechnology	02	--	**02**	02	--
	SELEEP1301 OR SELEEP1302	Practical Based on SELEET1301 OR Practical Based on SELEET1302	--	02	**02**	--	04
Vocational Course	SELEVC1301	C Programming	--	02	**02**	--	04
Field Project	SELEFP1301	Field Project in Electronics	--	04	**04**	--	08
Total Credits			**10**	**12**	**22**	**10**	**24**

B. Sc. Third Year Semester V *(Level 5.5)*

Examination Scheme

[40% Continuous Assessment (***CA***) and 60% End Semester Assessment (***ESA***)]

Subject (1)	Course Code (2)	Course Name (3)	Theory/Practical				ESA (8)	Total 7+8 (9)
			Continuous Assessment (CA)					
			Test (4)	Assignment (5)	Attendance (6)	Total (7)		
Major	SELECT1301	Analog Communication	15	09	06	30	45	75
	SELECP1301	Practical Based on SELECT1301	10	06	04	20	30	50
	SELECT1302	Power Electronics	15	09	06	30	45	75
	SELECP1302	Practical Based on SELECT1302	10	06	04	20	30	50
	SELEIKS1301	Evolution of Electronic Communication Systems in India	10	06	04	20	30	50
Elective	SELEET1301 OR SELEET1302	Embedded System Design OR Nanotechnology	10	06	04	20	30	50
	SELEEP1301 OR SELEEP1302	Practical Based on SELEET1301 OR Practical Based on SELEET1302	10	06	04	20	30	50
Vocational Course	SELEVC1301	C Programming	10	06	04	20	30	50
Field Project	SELEFP1301	Field Project in Electronics	20	12	08	40	60	100

B. Sc. Third Year Semester VI *(Level 5.5)*

Teaching Scheme

Subject	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	SELECT1351	Digital & Fiber Optic Communication	03	--	**03**	03	--
	SELECP1351	Practical based on SELECT1351	-	02	**02**	--	04
	SELECT1352	Sensors and Actuators	03	--	**03**	03	--
	SELECP1352	Practical based on SELECT1351	-	02	**02**	--	04
	SELECT1353	Python Programming	02	--	**02**	02	--
Elective	SELEET1351 OR SELEET1352	Introduction to VLSI Design OR Computer Hardware and Networking	02	--	**02**	02	--
	SELEEP1351 OR SELEEP1352	Practical based on SELEET1351 OR Practical based on SELEET1352	--	02	**02**	--	04
Vocational Course	SELEVC1351	Internet of Things	--	02	**02**	--	04
OJT	SELEOJT1351	On Job Training	--	04	**04**	--	08
Total Credits			**10**	**12**	**22**	**10**	**24**

Examination Scheme

[40% Continuous Assessment (***CA***) and 60% End Semester Assessment (***ESA***)]

Subject (1)	**Course Code** (2)	**CourseName** (3)	**Theory/Practical**				**ESA** (8)	**Total** 7+8 (9)
			Continuous Assessment (CA)					
			Test (4)	**Assignment** (5)	**Attendance** (6)	**Total** (7)		
Major	SELECT1351	Digital & Fiber Optic Communication	15	09	06	30	45	75
	SELECP1351	Practical based on SELECT1351	10	06	04	20	30	50
	SELECT1352	Sensors and Actuators	15	09	06	30	45	75
	SELECP1352	Practical based on SELECT1351	10	06	04	20	30	50
	SELECT1353	Python Programming	10	06	04	20	30	50
Elective	SELEET1351 OR SELEET1352	Introduction to VLSI Design OR Computer Hardware and Networking	10	06	04	20	30	50
	SELEEP1351 OR SELEEP1352	Practical based on SELEET1351 OR Practical based on SELEET1352	10	06	04	20	30	50
Vocational Course	SELEVC1351	Internet of Things	10	06	04	20	30	50
OJT	SELEOJT1351	On Job Training	20	12	08	40	60	100

SEM - V

B.Sc. TY (Electronics) (Semester V)
SELECT1301(Theory) (Major): Analog Communication

Periods: 45 Hours **Max. Marks: 75** [CA:30 & ESA:45] **Credits: 3**

Course pre-requisite:

- Basic knowledge of electronic devices and circuits (diodes, transistors)
- Understanding of signals and waveforms (sine wave, frequency, amplitude)
- Fundamentals of network theory (resistance, capacitance, inductance)
- Basic concepts of mathematics (trigonometry and simple calculus)

Course Objectives:

- Emphasize on the study of principles of communication theory.
- Focus on the fundamentals of communication system.
- Introduce the techniques of transmitting and receiving information signals using analog carrier modulation techniques (AM, FM, PM) and evaluate their performance levels (SNR) in the presence of channel noise.
- Establish foundation for understanding the relationship among various technical factors useful in designing & operating communication system.

Course Outcome: After completion of this course students will be able to

CO1: Enlist and classify analog communications
CO2: Describe analog Modulation techniques
CO3: Draw and Discuss block diagrams of AM & FM Receiver
CO4: Explain Pulse Analog Modulation System
CO5: Describe of different types of Multiplexing techniques

Curriculum Details:

SELECT1301 (Theory) (Major): Analog Communication

Module No.	Unit No.	Topic	No. of hours.
1		**Amplitude Modulation (AM)**	13
	1.1	Basic Communication System, Need of Modulation, Different types of Modulation, Concept of Bandwidth	
	1.2	Mathematical Representation of AM wave, Modulation Index of AM, Frequency Spectrum of the AM wave, Modulation Index Calculation using the AM wave, Power relations in AM wave	
	1.3	AM Transmitters: Low level Modulated AM Transmitter, High Level Modulated AM Transmitter	
	1.4	Evolution of Single Sideband (SSB) (Disadvantages of AM), Single Sideband Communication: DSB Signal, Single Sideband Signal (SSB)	
	1.5	AM Detector Circuits: Simple Diode Detector, Numerical problems.	
2		**Frequency Modulation (FM)**	10
	2.1	Theory of FM and PM, Modulation Index, Deviation Ratio, Mathematical Representation of FM, Frequency Spectrum of FM Wave, Practical Bandwidth	
	2.2	Phase Modulation (PM), Comparison of FM and PM Systems, Noise Triangle (Effect of Noise), Pre-emphasis and De-emphasis circuits	
	2.3	Generation of FM: Direct Methods for FM Generation (Basic Reactance Modulator using FET and Varactor Diode Modulator	
	2.4	Indirect Method (Armstrong Method) of FM Generation, Numerical Problems	
3		**AM and FM Receivers**	10
	3.1	AM Receivers: Function of Receiver, Tuned Radio Frequency (TRF) Receiver, Superheterodyne Receiver	
	3.2	Characteristics & Measurement of the Radio Receivers: Sensitivity, Selectivity, Fidelity, Image Frequency and its Rejection, Double Spotting	
	3.3	FM Receivers: Block diagram of FM Receiver	
	3.4	FM Demodulators: Principal of Slope Detector, Balanced Slope Detector,	
	3.5	Numerical Problems	
4		**Pulse Modulation**	12
	4.1	Classification of Pulse Modulation Systems, Continuous and Discrete Time Signals, Sampling Process: Sampling Theorem & Nyquist Rate, Pulse Amplitude Modulation (PAM): Generation & Detection of PAM, Frequency Spectrum of PAM, Advantages & Disadvantages of PAM	
	4.2	Pulse Width Modulation (PWM): Generation & Detection of PWM Signal, Advantages & Disadvantages of PWM	
	4.3	Pulse Position Modulation (PPM): Generation & Demodulation of PPM Signal, Advantages & Disadvantages of PPM, Comparison of PAM, PWM & PPM Systems	
	4.4	Multiplexing: Types of Multiplexing, Frequency Division Multiplexing (FDM), Application of FDM in Telephone System, Time Division Multiplexing (TDM), Comparison of FDM & TDM Systems	

Reference Books:

1. Modern Digital and Analog Communication Systems, B.P.Lathi and Zhi Ding, Oxford University Press
2. Electronic Communications, Dennis Roddy and John Coolen (Fourth Edition), PHI Publication.
3. Electronic Communication Systems, George Kennedy (Third Edition), Mc GrawHill International
4. Communication Engineering, J. S. Katre (First Edition) Technova Educational Publications.

B.Sc. TY (Electronics) (Semester V)

SELECP1301: Electronics Lab –VII (Practical)
(Practical based on Analog Communication)

Periods :60 Hours **Max. Marks: 50** [CA:20 & ESA:30] **Credits: 2**

Course Objectives:

- Familiarize with various Analog Communication Circuits
- To understand the design and working of AM, FM and Pulse Analog Modulators
- Understand the practical use of various Modulators and Demodulators in analog Communication System

Course outcome: After completion of this course students will be able to

CO1: Apply the concept and knowledge of Communication Systems

CO2: Design the electronic circuits required for communication systems (modulation and demodulation)

CO3: Construct the electronic circuits for Amplitude/Frequency modulation and demodulation.

CO3: Characterize the electronic circuits of communication systems.

List of Experiments:

SELECP1301: Electronics Lab- VII

Note: *A candidate is required to perform minimum **8** experiments out of the list provided during course of study in this semester.*

1. Study of Class–C Amplitude Modulation and Measurement of Efficiency, Percentage Modulation and Modulation Index
2. Study of Linear Diode Detector and Measurement of Detection Efficiency
3. Study of Frequency Response of Two Stage IF Amplifier
4. Study of Frequency Response of Audio Amplifier.
5. Study of Class B Push–Pull Amplifier using Complimentary Symmetry and Determination of Efficiency
6. Study of RF Mixer using BF 194 Transistor
7. Study of FM Modulation using IC 566
8. Study of FM Demodulator.
9. Study of Pulse Amplitude Modulation
10. Study of Pulse Position Modulation
11. Study of Pulse Width Modulation
12. Study and test the characteristics of pre-emphasis and de-emphasis circuits
13. Study of time division multiplexing and de-multiplexing using PAM signals.
14. Study of generation and detection of DSB-SC signal.
15. Study of generation and detection of SSB-SC signal.

B.Sc. TY (Electronics) (Semester V)
SELECT1302 (Theory) (Major): Power Electronics

Periods :45 Hours **Max. Marks: 75** [CA:30 & ESA:45] **Credits: 3**

Course pre-requisite:

- Basic knowledge of electronic devices (diodes, transistors)
- Understanding of analog electronics circuits
- Fundamentals of electrical circuits and network theory
- Basic concepts of waveforms and signal analysis.

Course Objectives:

- To understand the construction and working of power electronic devices.
- To analyse power electronic circuits for appropriate applications.
- To develop problem solving ability in power electronic circuit.
- To apply acquired skills for maintenance of power electronic circuits.

Course outcomes: After completion of this course students will be able to

CO1: Identify and select power semiconductor devices for specific applications.

CO2: Explain the construction and working principles of various power semiconductor devices.

CO3: Maintain the power electronic circuits for industrial applications.

CO4: Analyse various power electronic circuits.

Curriculum Details:

SELECT1302 (Theory) (Major): Power Electronics

Module No.	Unit No.	Topic	No. of hours
1		**Thyristors and Power Semiconductor Devices**	13
	1.1	Introduction, Principle of operation of SCR, Static Anode - Cathode Characteristics of SCR, The two-transistor model of SCR	
	1.2	Thyristor Construction, gate characteristics of SCR, Turn on methods of a thyristor. [Numerical]	
	1.3	Power semiconductor devices, structure and V-I characteristics of DIAC, TRIAC, IGBT	
	1.4	Symbol and V-I characteristics of SUS, SBS, & LASCR [Numerical]	
2		**Thyristor Triggering Circuits**	10
	2.1	Introduction, firing of thyristors, gate current amplitude and rise time, gate pulse duration	
	2.2	pulse waveforms, Pulse transformers, pulse transformer in triggering circuits	
	2.3	Gate trigger circuits, resistance firing circuits, resistance - capacitance firing circuit	
	2.4	resistor - Capacitor - full - wave trigger circuit, UJT as an SCR trigger [Numerical]	
3		**Phase Controlled Rectifier Circuits**	12
	3.1	Single-phase full-wave controlled rectifier (Two-quadrant Converters): Mid-point converters (M-2 Connection) with resistive load, with inductive load	
	3.2	effect of freewheeling diode, Bridge configuration (B-2 connection) with resistive load, with inductive load (R-L load)	
	3.3	Single-Phase half-controlled Bridge rectifier: Half controlled bridge rectifier with resistive load (symmetrical configuration), Half controlled Bridge rectifier with R-L load. (Symmetrical configuration) [Numerical]	
4		**Inverters and Chopper Circuits**	10
	4.1	Introduction, classification of Inverters, Series Inverters: Basic series inverter, modified series inverter, parallel inverter [Numerical]	
	4.2	Introduction, Basic chopper classification, Basic chopper operation: Principle of step-down chopper (buck converter)	
	4.3	principle of step-up chopper (Boost Converter)	

Reference Books:

1. Power Electronics, M.D. Singh & K.B. Khanchandani (2nd Edition), Mc Graw Hill - education.
2. Power Electronics, Muhammad H. Rashid (4th edition), Pearson.
3. Industrial Electronics & Control, S.K. Bhattacharya, S. Chatterjee, TTTI, Chandigarh
4. Power electronics, P.C. Sen, Mc Graw Hill – education
5. Power Electronics, Theory and Practical, Lalit Chandra Saikia, Khanna Book Publishing Co.
6. Power Electronics, P.S. Bimbhra, Khanna Publishers.

B.Sc. TY (Electronics) (Semester V)

SELECP1302: Electronics Lab –VIII (Practical)
(Practical based on Power Electronics)

Periods :60 Hours **Max. Marks: 50 [CA:20 & ESA:30]** **Credits: 2**

Course Objectives:

- To understand the characteristics of power semiconductor devices
- To study triggering methods and control of thyristor-based circuits
- To analyze performance of controlled rectifiers, inverters and choppers
- To develop skills in circuit implementation, measurement and waveform analysis

Course outcome: After completion of this course students will be able to

CO1: Perform and analyze characteristics of power semiconductor devices such as SCR, DIAC, TRIAC and IGBT

CO2: Implement and evaluate different SCR triggering circuits

CO3: Analyze operation of controlled rectifiers, inverters and chopper circuits

CO4: Measure electrical parameters and interpret output waveforms using CRO and instruments

List of Experiments:

SELECP1302: Electronics Lab- VIII

Note: *A candidate is required to perform minimum 8 experiments out of the list provided during course of study in this semester.*

1. To study V-I characteristics of UJT
2. To study UJT relaxation oscillator
3. To study firing characteristics of SCR
4. To study half-wave controlled rectifier using SCR
5. To study SCR triggering using UJT
6. To study phase control of SCR
7. To study characteristics of DIAC
8. To study firing characteristics of TRIAC
9. To study illumination control using DIAC and TRIAC
10. To study light activated switching using LDR with SCR/TRIAC
11. To study multi-SCR triggering using UJT (demonstration)
12. To study single-phase full-wave controlled rectifier
13. To study effect of freewheeling diode
14. To study inverter circuit using simulation / trainer kit
15. To study step-down or step-up chopper using simulation
16. To study switching characteristics of MOSFET / IGBT

B.Sc. TY (Electronics) (Semester V)

SELEIKS1301(Theory) Major (IKS): Evolution of Electronic Communication Systems in India

Periods :30 Hours **Max. Marks: 50 [CA:20 & ESA:30]** **Credits: 2**

Course pre-requisite:

- Knowledge of basic electronic components.
- Information of Electronic communication systems

Course Objectives:

- To understand the evolution of communication systems in India
- To study development of analog and digital communication technologies
- To explore growth of television and broadcasting systems
- To understand modern communication technologies and their impact

Course outcomes: After completion of this course students will be able to

- CO1: Discuss evolution of communication systems in India
- CO2: Explain working of basic telecommunication systems
- CO3: Describe development of broadcasting and television systems
- CO4: Analyze modern communication technologies and trends

Curriculum Details:

SELEIKS1301(Theory) Major (IKS): Evolution of Electronic Communication Systems in India

Module No.	Unit No.	Topic	No. of hours
1		**Evolution of Communication Systems**	**08**
	1.1	Introduction to communication systems and their importance	
	1.2	Growth of communication in India: telegram, telephone, pager	
	1.3	Evolution of radio communication: AM, FM, digital radio	
	1.4	Transition from wired to wireless communication	
2		**Basic Communication and Telephony Systems**	**08**
	2.1	Telegram system: concept and basic working	
	2.2	Telephone system: block diagram and working	
	2.3	Telephone exchange (basic idea)	
	2.4	Introduction to mobile communication: basic concept and working	
3		**Evolution and Types of Television Systems**	**08**
	3.1	Television system: basic block diagram and working	
	3.2	Evolution of television in India: Doordarshan, cable, satellite	
	3.3	Types of television: B/W, color, LED, LCD, smart TV	
	3.4	Role of television in communication and society	**06**
4		**Emerging Trends in Communication Technology**	
	4.1	Internet and digital communication: email, social media	
	4.2	Internet telephony: voice and video communication	
	4.3	Mobile communication generations: 3G, 4G, 5G (basic idea)	
	4.4	Emerging technologies: IoT and Artificial Intelligence (overview)	

References Books:

1. A. V. Gokak, *Telecommunications: Indian 50 Years of Independence (1947–97): Status, Growth and Development*, BR Publishing Corporation
2. George Kennedy & Bernard Davis, *Electronic Communication Systems*, McGraw-Hill Education, ISBN: 978-0078028229
3. Dennis Roddy & John Coolen, *Electronic Communications*, Pearson Education, ISBN: 978-8131709184
4. B. Mahadevan, Vinayak Rajat Bhat & Nagendra Pavana R.N., *Introduction to Indian Knowledge System*, PHI Learning, 2023, ISBN: 978-9391818098
5. R. Srinivasan, *Indian Scientific Heritage*, Universities Press, ISBN: 978-8173718724

B.Sc. TY (Electronics) (Semester V)
SELEET1301 (Theory)(Elective): Embedded system Design

Periods :30 Hours **Max. Marks: 50 [CA:20 & ESA:30]** **Credits: 2**

Course pre-requisite:

- Basic knowledge of microcontrollers (8051)
- Basic programming concepts

Course Objectives:

- To understand the fundamentals of embedded systems
- To develop programming skills using embedded C
- To interface input/output devices and sensors
- To design simple embedded systems for real-world application

Course outcomes: After completion of this course students will be able to

CO1: Explain the structure and operation of embedded systems

CO2: Develop embedded C programs for microcontrollers

CO3: Interface various peripheral devices and sensors

CO4: Design and implement basic embedded applications

Curriculum Details:

SELEET1301 (Theory)(Elective): Embedded system Design

Module No.	Unit No.	Topic	No. of hours
1		**Introduction to Embedded Systems**	**06**
	1.1	Definition and characteristics of embedded systems	
	1.2	Block diagram and components of embedded system	
	1.3	Types of embedded systems	
	1.4	Embedded system applications	
	1.5	Design challenges in embedded systems	
2		**Embedded C and Microcontroller Programming (8051)**	**08**
	2.1	Structure of embedded C program	
	2.2	Data types and memory considerations	
	2.3	I/O port programming	
	2.4	Delay generation using loops and timers	
	2.5	Timer and counter programming	
	2.6	Interrupts in embedded systems	
3		**Interfacing Techniques in Embedded Systems (8051)**	**08**
	3.1	Interfacing of switches, LEDs and relays	
	3.2	Display interfacing: 7-segment and LCD	
	3.3	Motor interfacing: DC motor and stepper motor	
	3.4	ADC and DAC interfacing	
	3.5	Sensor interfacing: temperature sensor, LDR	
	3.6	Sensor interfacing: gas sensor, ultrasonic sensor	
4		**Advanced Embedded System Concepts**	**08**
	4.1	Serial communication concepts (UART)	
	4.2	Basics of I2C and SPI	
	4.3	Introduction to wireless communication (Bluetooth/Wi-Fi)	
	4.4	Overview of modern microcontrollers (PIC)	
	4.5	Steps in embedded system design	
	4.6	Case studies of embedded systems	

References Books:

1. M. A. Mazidi & J. G. Mazidi The 8051 Microcontroller and Embedded Systems Pearson Education,
2. K. J. Ayala The 8051 Microcontroller Penram International Publishing,
3. Muhammad Ali Mazidi & Sarmad Naimi AVR Microcontroller and Embedded Systems Pearson Education,
4. Raj Kamal Embedded Systems: Architecture, Programming and Design McGraw-Hill Education,
5. Steven F. Barrett Embedded Systems Design with AVR Microcontroller Morgan & Claypool Publishers,

B.Sc. TY (Electronics) (Semester V)

SELEEP1301: Electronics Lab –IX(A) (Practical-Elective)
(Practical based on Embedded System Design)

Periods :60 Hours **Max. Marks: 50 [CA:20 & ESA:30]** **Credits: 2**

Course Objectives:

- To develop programming skills using embedded C for microcontrollers
- To understand interfacing of input/output devices, sensors and actuators
- To implement communication protocols such as UART, I2C and SPI
- To design and develop basic embedded systems for real-world applications

Course outcome: After completion of this course students will be able to

CO1: Write and execute embedded C programs for microcontroller-based systems

CO2: Interface and control peripherals such as LEDs, displays, motors and sensors

CO3: Implement serial communication protocols (UART, I2C, SPI) for data exchange

CO4: Design and develop simple embedded systems using hardware and software integration

List of Experiments:

SELEEP1301: Electronics Lab –IX(A) (Practical- Elective)

Note: *A candidate is required to perform minimum 8 experiments out of the list provided during course of study in this semester.*

1. To study I/O port programming using embedded C
2. To study IDE installation and write a simple embedded C program (LED blinking)
3. To generate delay using software loops and timers
4. To study timer programming for time delay generation
5. To study interrupt handling in embedded systems
6. To interface and control switches and LEDs
7. To interface and display data on 7-segment display
8. To interface LCD and display messages
9. To interface and control DC motor / stepper motor
10. To study ADC interfacing and analog signal reading
11. To interface sensors (temperature / LDR / ultrasonic) and display output
12. To study serial communication (UART) between microcontroller and PC / device
13. To generate PWM signal and control LED brightness / motor speed
14. To study DAC interfacing and analog output generation
15. To study I2C communication between microcontroller and peripheral device
16. To study SPI communication between microcontroller and peripheral device
17. To interface Bluetooth/Wi-Fi module and control device wirelessly
18. To design a simple embedded system (mini project)

B.Sc. TY (Electronics) (Semester V)
SELEET1302 (Theory) (Elective): Nanotechnology

Periods :30 Hours **Max. Marks: 50 [CA:20 & ESA:30]** **Credits: 2**

Course pre-requisite:

- Basic understanding of atomic structure, bonding and material properties
- Fundamentals of semiconductors, electricity and magnetism
- Knowledge of crystal structure and types of materials (metals, ceramics, polymers)
- Basic skills in mathematics, laboratory techniques and data analysis tools

Course Objectives:

- To understand concept, classification and importance of nanomaterials
- To study synthesis methods (physical and chemical) of nanomaterials
- To learn size-dependent properties and characterization techniques
- To explore applications of nanomaterials in electronics, energy and advanced devices

Course outcomes: After completion of this course students will be able to

CO1: Explain fundamentals and classification of nanomaterials

CO2: Describe synthesis methods and size-dependent properties

CO3: Understand characterization techniques such as XRD, SEM, TEM, AFM

CO4: Analyze applications of nanomaterials in various fields

Curriculum Details:

SELEET1302 (Theory) (Elective): Nanotechnology

Module No.	Unit No.	Topic	No. of hours
1		**Classification of Nanomaterials**	**09**
	1.1	Introduction of the nanomaterials	
	1.2	Zero-, one-, two-, and three-dimensional nanostructures	
	1.3	Nanosized metals, Carbon- based Nanomaterials and Composite Nanomaterials	
	1.4	Quantum dots, quantum wells, quantum rods, quantum wires, quantum rings	
2		**Physical and Chemical Synthesis of nanomaterials**	**09**
	2.1	Physical methods – Solid state, laser ablation, sputtering and microwave plasma	
	2.2	Chemical reduction and oxidation	
	2.3	Hydrothermal, micelles, sol-gel processes, Chemical bath deposition, coprecipitation and Metallo-organic chemical vapor deposition	
3		**Novel Properties of Nanomaterials**	**06**
	3.1	Size and shape dependent optical, emission, electronic properties	
	3.2	Transport, photonic, dielectric, mechanical, magnetic, properties	
	3.3	Non-linear optical properties.	
4		**Characterization of Nanomaterials**	**06**
	4.1	Structural Characterization - XRD, SEM, TEM, AFM.	
	4.2	Chemical Characterization – Optical spectroscopy, Electron spectroscopy.	
	4.3	Physical properties – Melting point, Lattice constant, Electrical and magnetic characterization.	

References Books:

1. Klabunde, K.J. (Ed.), “Nanoscale Materials in Chemistry”, John Wiley & Sons Inc. 2001.
2. Nalwa, H.S. (Ed.), “Encyclopedia of Nanoscience and Nanotechnology” 2004.
3. Sergeev, G.B. Nanochemistry, Elsevier, B.V. 2010.
4. Schmid, G. (Ed.), “Nanoparticles”, Wiley-VCH Verlag GmbH & Co. Kga 2004.
5. Rao, C.N.R., Müller, A. and Cheentham, A.K. (Eds.), “Chemistry of Nanomaterials”,
6. A textbook of Nanoscience and Nanotechnology’ by Pradeep T. Tata McGraw Hill

B.Sc. TY (Electronics) (Semester V)

SELEEP1302: Electronics Lab –IX(B) (Practical- Elective)
(Practical based on Nanotechnology)

Periods :60 Hours **Max. Marks: 50 [CA:20 & ESA:30]** **Credits:2**

Course Objectives:

- To provide practical knowledge of synthesis and characterization of nanomaterials.
- To develop skills in handling instruments used in nanotechnology laboratories.
- To understand the properties and applications of nanomaterials through experiments.
- To promote safe laboratory practices in nanotechnology research.
- To enhance analytical and problem-solving abilities through practical work.

Course outcome: After completion of this course students will be able to

CO1: Explain practical applications of nanotechnology in various fields.

CO2: Use characterization tools to analyze nanomaterials properties.

CO3: Interpret experimental results related to nanoparticle structure and behavior.

CO4: Apply safe handling and laboratory practices for nanomaterials.

CO5: Synthesize different nanomaterials using suitable techniques.

List of Experiments:

SELEEP1302: Electronics Lab –IX(B) (Practical- Elective)

Note: *A candidate is required to perform minimum 8 experiments out of the list provided during course of study in this semester.*

1. To understand dimensionality of nanomaterials. (Use balls/sticks/chart models to represent: 0D – Quantum dots, 1D – Nanorods / nanotubes, 2D – Thin films / graphene sheets, 3D – Nanocomposites).
2. To synthesize silver nanoparticles and observe colour change due to nanosized effect.
3. Sol-Gel Synthesis of Nanoparticles.
4. To reduce particle size using grinding. (Mortar-pestle or ball mill, any material powder)
5. Preparation of Nanoparticles by Precipitation Method.
6. Conductivity Measurement of Pellet.
7. Preparation of Nanoparticles by Hydrothermal Method.
8. Preparation of Nanoparticles by Co-precipitation.
9. Preparation of Nanoparticles by Chemical Bath Deposition.
10. Preparation of Nanoparticle by Chemical Vapor Deposition.
11. Preparation of Thin Films and Coatings.
12. Dip Coating on Glass Substrate.
13. Low-Cost Spin Coating Demonstration.
14. Polymer Nanocomposite Film Preparation.
15. Surface Area Effect Using Reaction Rate.
16. Particle Size Estimation by XRD (Scherrer Formula).
17. XRD analysis of nanomaterial (Lattice constant and X-ray density)
18. SEM Image Analysis (Demo Based).
19. TEM image Analysis (Demo Based)
20. AFM analysis of the nanomaterials
21. Conductivity Measurement of Nano powder Pellet.
22. pH Dependent Stability of Nanoparticles.
23. Optical Property Study Using UV-Visible Spectroscopy
24. Magnetic Behavior of Nanoparticles.
25. Tyndall Effect in Nano colloid.
26. Surface Area Comparison Experiment.
27. Magnetic Response Test of Nanoparticles.
28. Adsorption of Dye using Activated Carbon.
29. UV-Visible Spectrum of Nanoparticles.

B.Sc. TY (Electronics) (Semester V)

SELEVC1301: C Programming (Vocational Skill)

Periods :60 Hours **Max. Marks: 50 [CA:20 & ESA:30]** **Credits: 2**

Course Objectives:

- To develop programming skills using C language fundamentals
- To understand and implement decision-making and looping constructs
- To learn use of arrays, functions and strings in problem solving
- To develop logical thinking using pointers and structured programming concepts

Course outcome: After completion of this course students will be able to

CO1: Write and execute basic C programs using input-output and operators

CO2: Implement decision-making and looping constructs for problem solving

CO3: Use arrays, functions and strings to develop structured programs

CO4: Apply pointers for efficient data handling and program design

SELEVC1301: C Programming (Vocational Skill)

Note: *A candidate is required to perform minimum 8 Programs out of the list provided during course of study in this semester.*

1. To write and execute a basic input-output program
2. To perform arithmetic operations using operators
3. To implement type casting and formatted input/output
4. To write a program using simple if condition
5. To write a program using if-else and nested if
6. To implement switch-case statements
7. To generate multiplication table using for loop
8. To write programs using while and do-while loops
9. To find factorial and Fibonacci series using loops
10. To perform operations on arrays (1D array)
11. To perform matrix operations (2D array)
12. To search and sort elements in an array
13. To define and use user-defined functions
14. To implement recursive functions
15. To pass arguments to functions (call by value and reference)
16. To perform string operations using library functions
17. To use pointers and pointer arithmetic
18. To implement pointer with arrays and functions

B.Sc. T. Y. (Electronics) (Semester V)

Project

Periods :120 Hours **Max. Marks: 100 [CA:40 & ESA:60]** **Credits: 4**

Course pre-requisite:

- Basic knowledge of core electronics subjects (analog, digital, microcontrollers)
- Fundamental understanding of programming concepts (Arduino / Embedded C / Python
- Familiarity with basic electronic components and circuits
- Basic skills in using tools, instruments, and software for design or simulation
- Ability to work independently and in a team

Course Objectives:

- To apply theoretical knowledge to real-world problems
- To develop design, implementation, and troubleshooting skills
- To encourage independent learning, creativity, and innovation
- To enhance technical communication and documentation skills

Course outcomes:

- **CO1:** Identify and define an appropriate engineering problem
- **CO2:** Design and develop a suitable solution
- **CO3:** Analyse results and evaluate system performance
- **CO4:** Present and document the project work effectively

Project General Guidelines

- The project may be carried out individually or in a group (maximum 3 students)
- The work should involve design, development, and testing
- Projects may be based on:
  - ✓ Hardware
  - ✓ Software
  - ✓ Simulation
  - ✓ Or a combination of these
- The problem should be relevant, feasible, and clearly defined
- Students must demonstrate understanding of concepts used
- Regular interaction with the project guide is mandatory

Project Execution Stages

Stage 1: Problem Definition

- Selection of project topic
- Identification of objectives
- Background study and literature review

Stage 2: Design and Planning

- System design / methodology
- Preparation of block diagram / flowchart
- Selection of components, tools, and techniques

Stage 3: Implementation

- Development of system (hardware/software/simulation)
- Testing, debugging, and refinement

Stage 4: Result Analysis and Submission

- Observation and analysis of results
- Preparation of final report
- Demonstration and presentation

Evaluation Scheme (100 Marks)	**Project Report Format**
Continuous Assessment – 40 Marks **Final Evaluation – 60 Marks** • Demonstration / results – 25 marks • Project report – 15 marks • Presentation – 10 marks • Viva voce – 10 marks	The final report should include: 1. Title Page 2. Abstract 3. Introduction 4. Literature Survey / Background 5. System Design / Methodology 6. Implementation Details 7. Results and Discussion 8. Conclusion and Future Scope 9. References

SEM- VI

B.Sc. T. Y. (Electronics) (Semester VI)

SELECT1351(Theory) (Major): Digital & Fiber Optic Communication

Periods :45 Hours **Max. Marks: 75 [CA:30 & ESA:45]** **Credits: 3**

Course pre-requisite:

- Basic knowledge of analog communication
- Fundamentals of signals and systems
- Basic digital electronics

Course Objectives:

- To understand fundamentals of digital communication systems
- To study sampling, PCM and delta modulation techniques
- To learn digital modulation methods
- To understand Fiber Optic Communication

Course outcomes: After completion of this course students will be able to

CO1: Explain basic concepts of digital communication systems

CO2: Describe sampling, PCM and delta modulation

CO3: Explain Fiber Optic Communication

CO4: Interpret basic application of Optical Fiber

CO5: Analyze digital modulation techniques

Curriculum Details:

SELECT1351(Theory) (Major): Digital & Fiber Optic Communication

Module No.	Unit No.	Topic	No. of hours
1		**Digital Communication System and Coding Methods**	**12**
	1.1	Elements of basic digital communication system with its block diagram: Source encoder and decoder, Channel encoder and decoder, modulator and demodulator, Advantages and disadvantages of digital communication	
	1.2	Communication channel characteristics: bit rate, baud rate, bandwidth, repeater distance	
	1.3	Error detection codes: Vertical Redundancy Check (VRC) code, Longitudinal Redundancy Check (VRC) code, Cyclic Redundancy Check (CRC) code, Checksum code and Hamming code generation	
	1.4	Line coding: Need, properties, Unipolar RZ and NRZ, Polar RZ and NRZ, split phase and differential Manchester.	
2		**Pulse Code Modulation Techniques**	**11**
	2.1	Sampling & quantization process: Nyquist sampling theorem, types of sampling, aliasing effect, quantization process, quantization error, companding	
	2.2	Pulse code modulation (PCM), Block diagram of transmitter and receiver with its working principle, Advantages and disadvantages	
	2.3	Delta modulation (DM): Block diagram of transmitter and receiver with its working principle, slope overload, granular noise. Advantages and disadvantages	
	2.4	Adaptive Delta modulation (ADM): Block diagram of transmitter and receiver with its working principle, Advantages and disadvantages	
3		**Digital Modulation Techniques**	**10**
	3.1	Types of digital modulation techniques and their advantages, concept of coherent and non-coherent detection	
	3.2	Shift keying techniques: Block diagram of transmitter and receiver with its working principle for Amplitude Shift Keying (ASK), Frequency Shift keying (FSK), Phase Shift keying (PSK)	
	3.3	Differential Phase Shift keying (DPSK), Quadrature Phase Shift keying (QPSK).	

4		**Introduction to Optical Fibers**	**12**
	4.1	Introduction to Fiber optic communication and need Structure and classification of optical Fibers	
	4.2	Fiber optic communication system block diagram	
	4.3	Propagation of light, Refraction and Snell's law	
	4.4	Total internal reflection and light propagation through an Optical Fiber, Acceptance angle and Numerical aperture	
	4.5	Fiber losses and attenuation, Dispersion, Intermodal Dispersion, Fiber Characteristics.	
	4.6	Advantages & Disadvantages of optical fibers, Numerical Problems	

References Books:

1. J. S. Katre, *Digital Communication*, Tech-Max Publications
2. B. P. Lathi & Zhi Ding, *Modern Digital and Analog Communication Systems*, Oxford University Press
3. Simon Haykin & Michael Moher, *Introduction to Analog and Digital*, John Wiley & Sons, Inc.
4. P. Ramakrishna Rao , *Digital Communication*, McGraw-Hill Education
5. Prof. Muralidhar Kulkarni & Prof. K. S. Shivaprakasha, Digital Communication, Khanna Publishing House
6. John G. Proakis & Masoud Salehi, *Digital Communication,* McGraw-Hill Education
7. T L Singal, *Digital Communication,* McGraw Hill Education (India) Private Limited
8. Optical Fibres and Fibre Optic Communication Systems, S.K. Sarkar, *S.Chand and Company Ltd., New Delhi*.
9. Optical Fiber Communications: Principles & Practice – John M Senior, III edition PHI
10. B.L. Thereja , Basic Electronics: Solid State, *S.Chand and Company Ltd., New Delhi*.

B.Sc. TY (Electronics) (Semester VI)

SELECP1351: Electronics Lab –X (Practical)
(Based on Digital & Fiber Optic Communication)

Periods :60 Hours **Max. Marks: 50 [ESE:30 & CA:20]** **Credits: 2**

Course Objectives:

- To understand fundamental concepts of digital communication systems
- To develop skills in signal generation, sampling and coding techniques
- To study and analyze digital modulation methods
- To learn practical implementation using simulation and communication system tools

Course outcome: After completion of this course students will be able to

CO1: Generate and analyze different line coding and digital signals

CO2: Implement sampling, PCM and delta modulation techniques

CO3: Analyze digital modulation schemes such as ASK, FSK and PSK

CO4: Apply simulation tools to study digital communication systems and interpret results

List of Experiments:

SELECP1351: Electronics Lab –X (Practical)

Note: *A candidate is required to perform minimum 8 experiments out of the list provided during course of study in this semester.*

1. To generate NRZ, RZ and Manchester line coding
2. To study different line coding schemes using simulation
3. To generate parity bit for given data
4. To study error detection using CRC (simulation)
5. To generate Hamming code for given data
6. To study error detection and correction using Hamming code
7. To study sampling of analog signal (natural and flat-top)
8. To verify Nyquist sampling theorem using simulation
9. To study PCM generation and reconstruction
10. To study Differential PCM (DPCM)
11. To study Delta modulation
12. To study Adaptive Delta modulation
13. To generate ASK signal
14. To generate FSK / PSK signal
15. To study TDM using simulation / trainer kit
16. To study transmission and reception through optical Fiber (demonstration/simulation)
17. Study of the Characteristics of Laser LED
18. Study of Photo-Diode Detector Characteristics (Use Avalanche Photo Diode)
19. To measure Numerical Aperture of Optical Fiber
20. To study bending loss of an Optical Fiber

B.Sc. T. Y. (Electronics) (Semester VI)
SELECT1352(Theory) (Major): Sensors and Actuators

Periods :45 **Hours Max. Marks: 75 [CA:30 & ESA:45]** **Credits: 3**

Course pre-requisite:

- Basic knowledge of analog and digital electronics
- Fundamentals of electrical quantities and measurements

Course Objectives:

- To understand principles and classification of sensors and transducers
- To study commonly used sensors and their applications
- To understand actuators and their working mechanisms
- To learn signal conditioning and data conversion techniques
- To develop understanding of measurement and control systems

Course outcomes: After completion of this course students will be able to

CO1: Explain principles and performance parameters of sensors and transducers

CO2: Describe working and applications of various sensors

CO3: Select actuators and their operation in control systems

CO4: Analyze signal conditioning and data conversion techniques

CO5: Apply concepts in basic measurement and control systems

Curriculum Details:

SELECT1352(Theory) (Major): Sensors and Actuators

Module No.	Unit No.	Topic	No. of hours
1		**Basics of Sensors and Transducers**	**10**
	1.1	Need and classification of sensors and transducers	
	1.2	Active and passive transducers – definition and working principle	
	1.3	Examples: thermocouple (active), strain gauge (passive)	
	1.4	Operating principles of sensors	
	1.5	Performance characteristics: accuracy, resolution, sensitivity, linearity, Hysteresis, range, reliability, selectivity, Static and dynamic characteristics (Numerical problems)	
2		**Types of Sensors and Their Applications**	**12**
	2.1	Temperature sensors: RTD, thermistor, thermocouple	
	2.2	Light sensors: LDR, photodiode	
	2.3	Position and motion sensors	
	2.4	Level, humidity and pH sensors – overview	
	2.5	Special sensors: load cell, gas sensor, ultrasonic sensor	
3		**Electrical and Electromechanical Actuators**	**11**
	3.1	Introduction and classification of actuators	
	3.2	Electrical actuators: relay and solenoid – principle and operation	
	3.3	Electromechanical actuators: DC motor, stepper motor and servo motor – construction and working	
	3.4	Control devices: valves and power control devices – overview and applications	
4		**Signal Conditioning and Data Conversion**	**12**
	4.1	Signal conditioning: need and techniques	
	4.2	Amplification, filtering and linearization – concept and application	
	4.3	Analog and digital signal transmission – fundamentals	
	4.4	Data converters: ADC and DAC – principle and operation	
	4.5	Binary weighted and R-2R ladder DAC – working and comparison	
	4.6	ADC techniques: flash, successive approximation	

References Books:

1. William C. Dunn, Fundamentals of Industrial Instrumentation and Process Control, McGraw-Hill Publication, 2005
2. Steve Mackay, Edwin Wright, Deon Reynders, John Park, Practical Industrial Data Networks: Design, Installation and Troubleshooting, Newnes (Elsevier), 2004
3. Edwin Wright, Deon Reynders, Practical Telecommunications and Wireless Communications for Business and Industry, Newnes (Elsevier), 2004
4. D. Shaligram, Sensors and Transducers, Chintan Publication, 2013
5. D. Patranabis, Sensors and Transducers, Prentice Hall Publication, 2008
6. R. Y. Borse, Sensors and Transducers: Principles and Applications, Adhyan Publishers & Distributors, New Delhi, 2012
7. A.K.Sawhney, A Course in Electrical and Electronics Measurement and Instrumentation, Dhanpat Rai & Co.(Pvt) Ltd.
8. B.S. Nakara and V.S.Mani, Instrumentation, Measurement and analysis, (TMH)
9. C S Rangan, G R Sharma V S and V Mani, Instrumentation devices and systems (TMH)
10. D.V.S. Murty,Transducers and instrumentation PHI, Ltd. New Delhi.

B.Sc. TY (Electronics) (Semester VI)

SELECP1352: Electronics Lab –XI (Practical)

(Based On Sensor and Actuators)

Periods :60 Hours **Max. Marks : 50 [CA:20 & ESA:30]** **Credits: 2**

Course Objectives:

- To understand working principles of sensors and transducers
- To develop skills in measurement of physical parameters using sensors
- To study operation and control of actuators such as motors, relays and solenoids
- To learn signal conditioning and interfacing techniques in measurement systems

Course outcome: After completion of this course students will be able to

CO1: Perform experiments using various sensors and analyze their characteristics

CO2: Interface sensors and obtain measurement data for physical parameters

CO3: Operate and control different actuators in practical applications

CO4: Implement basic signal conditioning and data acquisition techniques

List of Experiments:

SELECP1352: Electronics Lab –XI (Practical)

Note: *A candidate is required to perform minimum 8 experiments out of the list provided during course of study in this semester.*

1. To study temperature measurement system using any two sensors (Thermistor / LM35 / RTD)
2. To Study of thermocouple (594/595)
3. Measurement using Strain Gauge and Bridge Amplifier
4. To Study of ON/OFF Temperature controller (LM34/LM35/AD590)
5. To Study of characteristic of phototransistor
6. To Study of pressure transducer
7. To Study of Photo voltaic cell.
8. To study light measurement system using LDR and photodiode
9. To study gas sensor or load cell measurement system (demonstration / interfacing)
10. To study proximity / IR sensor for object detection
11. To study level measurement system (water level indicator)
12. To study displacement measurement using potentiometer or LVDT (demonstration/simulation)
13. To study and control DC motor using driver circuit
14. To study stepper motor operation and control
15. To study servo motor control using PWM
16. To study operation of relay and solenoid
17. To study signal conditioning using operational amplifier (amplifier/filter)
18. To study ADC using microcontroller / ADC IC
19. To study DAC using R-2R ladder network

B.Sc. T. Y. (Electronics) (Semester VI)

SELECT1353(Major) (Theory): Python Programming

Periods :30 Hours **Max. Marks: 50 [CA:20 & ESA:30]** **Credits: 2**

Course pre-requisite:

- Basic knowledge of computers and operating systems
- Familiarity with fundamental programming concepts
- Understanding of basic mathematics and logical reasoning

Course Objectives:

- To develop programming skills using Python
- To understand control structures and data handling
- To use functions and basic file operations
- To introduce structured programming and simple applications

Course outcomes: After completion of this course students will be able to

CO1: Write Python syntax and constructs

CO2: Apply control structures for problem solving

CO3: Use data structures effectively

CO4: Develop modular programs using functions

CO5: Perform basic file handling and understand program structure

Curriculum Details:

SELECT1353(Major) (Theory): Python Programming

Module No.	Unit No.	Topic	No. of hours
1		**Introduction to Python Programming**	08
	1.1	Introduction to Python, features and applications	
	1.2	Installation and execution of Python programs	
	1.3	Syntax, indentation, comments, identifiers and keywords	
	1.4	Variables and data types (int, float, string)	
	1.5	Input/output functions and operators	
2		**Decision Making and Looping in Python**	07
	2.1	Conditional statements: if, if-else, nested if	
	2.2	Looping: for loop, while loop	
	2.3	Loop control: break, continue	
	2.4	Programs using control structures	
3		**Lists, Tuples and Dictionaries in Python**	08
	3.1	Lists: creation, indexing, operations	
	3.2	Tuples and basic operations	
	3.3	Dictionaries and basic operations	
	3.4	Introduction to strings and basic operations	
4		**Python Functions and Applications**	07
	4.1	Built-in functions and standard functions	
	4.2	User-defined functions (arguments, return values)	
	4.3	Scope of variables (local and global)	
	4.4	Introduction to file handling (read/write text files)	
	4.5	Simple applications and problem-solving programs	

References Books:

1. Yashwant Kanetkar Let Us Python BPB Publications,
2. Paul Barry Head First Python O' Reilly Media,
3. Mark Lutz Learning Python O' Reilly Media,
4. Martin C. Brown Python: The Complete Reference McGraw-Hill Education,

B.Sc. T. Y. (Electronics) (Semester VI)
SELEET1351(Theory) (Elective): Introduction to VLSI Design

Periods :30 Hours **Max. Marks: 50 [CA:20 & ESA:30]** **Credits: 2**

Course pre-requisite:

- Basic Digital Electronics
- Logic Gates, Boolean Algebra
- Combinational and Sequential Circuits

Course Objectives:

- To introduce digital system design using HDL
- To understand VHDL programming fundamentals
- To design combinational and sequential circuits using VHDL
- To develop simulation and basic verification skills
- To introduce PLDs such as FPGA and CPLD

Course outcomes: After completion of this course students will be able to

CO1: Describe Verilog HDL syntax and modeling styles

CO2: Design combinational circuits using VHDL

CO3: Design sequential circuits using VHDL

CO4: Simulate and verify digital systems and understand PLD concepts

Curriculum Details:

SELEET1351(Theory) (Elective): Introduction to VLSI Design

Module No.	Unit No.	Topic	No. of hours required to cover the contents
1		**Digital Design Fundamentals & VHDL Basics**	**08**
	1.1	Digital system design flow, need of HDL	
	1.2	Introduction to VHDL, levels of abstraction	
	1.3	Verilog module structure, data types (wire, reg)	
	1.4	Operators and simple combinational examples	
2		**Combinational Logic Design using VHDL**	**07**
	2.1	Gate-level modeling and basic logic gates	
	2.2	Dataflow modeling (assign statements)	
	2.3	Design of adder, subtractor, MUX/DEMUX	
	2.4	Encoder, decoder, comparator, simulation basics	
3		**Behavioral Modeling & Sequential Circuits**	**07**
	3.1	Behavioral modeling: always, initial blocks	
	3.2	Blocking vs non-blocking, if, case, loops	
	3.3	Flip-flops (SR, JK, D, T) using VHDL	
	3.4	Registers, shift registers, counters, FSM intro	
4		**PLDs, Testbench & Applications**	**08**
	4.1	PLDs: PAL, PLA, CPLD, FPGA (overview)	
	4.2	Testbench concepts, simulation and verification	
	4.3	Design examples: BCD to 7-segment, traffic controller	

Recommended Books/References:

1. J. Bhasker – A VHDL Primer, Prentice Hall
2. Gaganpreet Kaur – VHDL: Basics to Programming, Pearson Education India
3. Michel D. Ciletti – *Advanced Digital Design with VHDL HDL*
4. William Kleitz – Digital Electronics: A Practical Approach with VHDL, Pearson
5. Ian Grout – Digital Systems Design with FPGAs and CPLDs, Newnes

B.Sc. TY (Electronics) (Semester VI)

SELEEP1351: Electronics Lab –XII(A) (Practical-Elective)
(Based on Introduction to VLSI Design)

Periods :60 Hours **Max. Marks : 50 [CA:20 & ESA:30]** **Credits : 2**

Course Objectives:

- To develop skills in digital system design using VHDL
- To understand different modeling styles: gate-level, dataflow and behavioral
- To design and simulate combinational and sequential circuits
- To learn testbench development and verification of digital systems

Course outcome: After completion of this course students will be able to

CO1: Write and simulate VHDL programs using different modeling techniques

CO2: Design combinational and sequential digital circuits using VHDL

CO3: Implement registers, counters and finite state machines

CO4: Develop testbenches and verify functionality of digital systems

List of Experiments:

SELEEP1351: Electronics Lab –XII(A) (Practical-Elective)

Note: *A candidate is required to perform minimum 8 experiments out of the list provided during course of study in this semester.*

1. To study introduction to VHDL and simulation tools
2. To study VHDL data types and operators
3. To study gate-level modeling of logic circuits
4. To study dataflow modeling of combinational circuits
5. To design combinational circuits using VHDL (adder, multiplexer, decoder)
6. To study behavioral modeling using if-else statements
7. To study behavioral modeling using case statements
8. To implement basic flip-flops (SR, JK, D, T) using VHDL
9. To design registers and shift registers using VHDL
10. To design counters (up, down, mod-n) using VHDL
11. To design arithmetic circuits (half adder, full adder, subtractor) using VHDL
12. To design a finite state machine (FSM) using VHDL
13. To study timing control and delay statements in VHDL
14. To design and implement a testbench for digital circuits
15. To design and simulate a simple digital system (mini project)

B.Sc. TY (Electronics) (Semester VI)
SELEET1352(Theory) (Elective): Computer Hardware and Networking

Periods: 30 Hours **Max. Marks: 50 [CA:20 & ESA:30]** **Credits: 2**

Course pre-requisite:

- Basic knowledge of computers and digital electronics
- Understanding of basic electronic components
- Familiarity with operating systems

Course Objectives:

- To understand structure and working of computer hardware systems
- To learn assembly, troubleshooting and maintenance of computers
- To understand fundamentals of computer networking
- To develop basic skills in network configuration and design

Course Outcome: After completion of this course students will be able to

CO1: Explain computer hardware components and their functions

CO2: Assemble and troubleshoot basic computer systems

CO3: Describe fundamentals of computer networking and data communication

CO4: Configure and analyze simple wired and wireless networks

Curriculum Details

SELEET1352(Theory) (Elective): Computer Hardware and Networking

Module No.	Unit No.	Topic	No. of hours
1		**Basic Architecture of Computer Systems**	**08**
	1.1	Functional block diagram of computer system	
	1.2	CPU organization: ALU, CU, registers and bus system	
	1.3	Motherboard components and chipsets	
	1.4	Memory types: RAM, ROM, cache and their characteristics	
	1.5	Storage devices: HDD, SSD and interfaces	
	1.6	Input-output devices and ports	
2		**Computer System Setup and Maintenance**	**07**
	2.1	Identification of computer hardware components	
	2.2	Steps in computer assembly and system setup	
	2.3	BIOS/UEFI and booting process	
	2.4	Installation of operating system (concept and steps)	
	2.5	Common hardware faults and troubleshooting techniques	
	2.6	Preventive maintenance and safety practices	
3		**Fundamentals of Computer Networks**	**08**
	3.1	Introduction to computer networks and data communication	
	3.2	Types of networks: LAN, WAN, MAN	
	3.3	Network topologies: star, bus, ring, mesh	
	3.4	OSI model – functions of each layer	
	3.5	TCP/IP model and comparison with OSI	
	3.6	IP addressing (IPv4 basics)	
4		**Networking Devices and Network Security**	**07**
	4.1	Networking devices: hub, switch, router, modem – working and use	
	4.2	Transmission media: UTP, STP, optical fiber (basic concept)	
	4.3	Wired and wireless networks (Wi-Fi basics)	
	4.4	Network configuration: IP setting, file and printer sharing	
	4.5	Introduction to network security: passwords, firewall basics	
	4.6	Basic network troubleshooting techniques	

References Books:

1. Jean Andrews, CompTIA A+ Guide to IT Technical Support, Cengage Learning
2. Andrew S. Tanenbaum, Computer Networks, Pearson Education
3. Behrouz A. Forouzan, Data Communications and Networking, McGraw-Hill
4. Kurose & Ross, Computer Networking: A Top-Down Approach, Pearson
5. Scott Mueller, Upgrading and Repairing PCs, Pearson

B.Sc. TY (Electronics) (Semester VI)

SELEEP1352: Electronics Lab –XII(B) (Practical-Elective)
(Based on Computer Hardware and Networking)

Periods :60 Hours **Max. Marks: 50 [CA:20 & ESA:30]** **Credits: 2**

Course Objectives:

- To develop hands-on skills in identification and assembly of computer hardware
- To learn installation and configuration of operating systems and system settings
- To understand and implement basic networking and connectivity setup
- To develop troubleshooting skills for hardware and network-related problems

Course outcome: After completion of this course students will be able to

CO1: Identify, assemble and configure basic computer hardware systems

CO2: Install operating systems and perform system configuration tasks

CO3: Set up and manage basic wired and wireless networks

CO4: Diagnose and troubleshoot common hardware and networking issues

List of Experiments:

SELEEP1352: Electronics Lab –XII(B) (Practical-Elective)

Note: *A candidate is required to perform minimum 8 experiments out of the list provided during course of study in this semester.*

1. To study internal components of a computer system
2. To study external ports and connectors of a computer
3. To assemble a desktop computer system
4. To study BIOS/UEFI settings
5. To install operating system
6. To study memory and storage devices
7. To identify and troubleshoot common hardware problems
8. To prepare LAN cable using crimping tool
9. To study network topologies using simulation
10. To configure IP address in a computer
11. To study networking devices (hub, switch, router, modem)
12. To set up a small LAN network
13. To study file and printer sharing in network
14. To configure Wi-Fi network and security settings
15. To troubleshoot basic network issues

B.Sc. TY (Electronics) (Semester VI)

SELEVC1351: Internet of Things (Vocational Skill)

Periods :60 Hours **Max. Marks : 50 [CA:20 & ESA:30]** **Credits-2**

Course Objectives:

- To develop skills in building IoT-based systems using microcontrollers (ESP32/NodeMCU)
- To understand interfacing of sensors and actuators in IoT applications
- To learn data communication using Wi-Fi and IoT protocols
- To design and implement real-world IoT applications

Course outcome: After completion of this course students will be able to

CO1: Interface sensors and actuators with IoT-enabled microcontrollers

CO2: Implement wireless communication using Wi-Fi for data transmission

CO3: Develop simple IoT applications for monitoring and control

CO4: Analyze and deploy IoT systems for real-world use cases

SELEVC1351: Internet of Things (Vocational Skill)

Note: *A candidate is required to perform minimum 8 experiments out of the list provided during course of study in this semester.*

1. Installation of Arduino IDE and setup for ESP8266/ESP32 boards; upload a basic test program.
2. Study of NodeMCU (ESP8266/ESP32) pin configuration and basic input/output operations.
3. Write and execute a program to blink an LED using NodeMCU.
4. Interface a push button with NodeMCU and read its status.
5. Control an LED using Bluetooth (ESP32) via mobile application.
6. Control an LED using Wi-Fi (NodeMCU) through a web server.
7. Design and host a simple web page on NodeMCU to control an LED ON/OFF.
8. Design and implement a local web server on ESP8266/ESP32 to control devices within a local network.
9. Display data on Serial Monitor and web interface simultaneously.
10. Interface an LDR sensor with Node MCU and display data on Serial Monitor.
11. Interface a temperature sensor (DHT11/LM35) with Node MCU and display readings.
12. Interface an ultrasonic sensor with Node MCU and display distance on web browser.
13. Interface a relay with Node MCU and control it using Wi-Fi.
14. Control a DC motor using Node MCU via Wi-Fi commands.
15. Interface a temperature sensor with ESP8266/ESP32 and upload data to ThingSpeak cloud.
16. Interface soil moisture / accelerometer sensor with ESP8266/ESP32 and upload data to ThingSpeak cloud.
17. Implement ESP-NOW communication between two ESP8266/ESP32 modules and transmit data wirelessly.