V SEMESTER

Core 6: MICROPROCESSOR AND MICROCONTROLLER

Preamble: Microprocessor and Microcontroller have become important building blocks in digital electronics design. It is important for student to understand the architecture of a microprocessor and its interfacing with various modules. 8085 microprocessor architecture, programming, and interfacing is dealt in detail in this course. Interfacing, assembly language programming and interfacing of 8051 microcontroller and its application in industry are also covered in this course.

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
Part - III	Core-06	U21EL506	Microprocessor and Microcontroller	85	5	-	4

Conduct hours per semester: 90
Conduct hours per week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
Third	V	25	75	100

Course Outcomes (COs)

On successful completion of the course, the learners be able to

Co No.	Course Outcome	Knowledge Level (RBT)
1	understand the basics of 8085 and 8051.	K1
2	able to understand the addressing modes and Instruction set of Microprocessors and Microcontrollers	K2
3	explain various peripherals devices such as 8255, 8251, 8259 and 8257	K3
4	develop an ALP in microprocessor and microcontroller using the internal organization for the given specification	K4
5	able to interface MP and MC with other electronic devices	K5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO Mapping (Course Articulation Matrix)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	0	0	3	3
CO2	2	3	3	1	2	0	2
CO3	3	3	3	3	1	2	3
CO4	3	3	3	2	2	2	3
CO5	3	2	2	3	2	3	3
Total Contribution of COs to POs	14	14	14	09	7	10	14
Weighted Percentage of COs Contribution to POs	93.3	93.3	93.3	60	46.7	66.7	93.3

0 – Not Correlation 1 – Low 2 – Moderate 3 - High

COURSE CONTENT

UNIT I 8085 ARCHITECTURES (L-17Hrs + T – 1Hr)

Architecture of 8085 -Instruction set – Data Transfer, Arithmetic, Logical, Branching and I/O Instruction, Instruction types- various Addressing Modes. Timing sequence- Instruction cycle- Machine cycle- Halt wait state-. ALP- Mnemonic, Op-code - simple Assembly language program flow chart stack and subroutines- Interrupts.

UNIT II INTERFACE CONTROLLERS (L-17Hrs + T – 1Hr)

Peripheral device – Programmable peripheral Interface (8255 A) - Programmable Interrupt controller (8259 A) - USART- Serial Communication Interface (8251). Programmable DMA Controller (8257). Interfacing –Analog to Digital Converter- Stepper Motor – Key Board & Display Interface.

UNIT III 8051 MICROCONTROLLER (L-17Hrs + T – 1Hr)

Intel 8051 microcontroller – Block Diagram, pin out – oscillator and clock – Program Counter and Data pointer, A and B registers, flags and program status word – Internal RAM – the Stack and Stack pointer –special functions registers – Internal ROM – I/O Pins, ports and circuits – External memory. Counters, Timers and Addressing Modes

UNIT IV 8051 INSTRUCTIONS (L-17Hrs + T – 1Hr)

Data exchanges – Logical operations – Byte level operation – Bit level logical operations – Rotate and swap operations – Arithmetic operations – Jump and call instructions – Interrupts and return.

UNIT V 8051 PROGRAMMING (L-17Hrs + T – 1Hr)

Assembly Language programming for 8051 Micro controller family – Arithmetic and Logical Programs – Interfacing Keyboard – Interfacing LED, LCD Display – A/D and D/A Interfacing.

Tutorial Section

Unit	Topic	Hours
I	Architecture of 8085 -Instruction set	1
II	Programmable peripheral Interface (8255 A)	1
III	Counters, Timers	1
IV	Interrupts	1
V	Interfacing LED, LCD Display	1

TEXT BOOKS:

1. S. Ramesh Gaonkar, "Microprocessor Architecture Programming and applications with 8085/8080A" Wiley Eastern Limited (1986) ---- (Unit I & II)
2. Kennath J. Ayala, "8051 Micro controller Architecture, Programming and Applications" Penram International Publishing ---- (Unit III, IV & V)

Reference Books

1. Douglas V. Hall, "Microprocessor and Interfacing: Programming and Hard ware" Mc Graw Hill, New York (1988)
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D McKinlay, "The 8051 microcontroller and embedded systems using assembly and C" second edition Pearson education Asia

Websites for Reference

1. **https://www.slideshare.net/**
2. **https://www.tutorialspoint.com/microprocessor/index.htm**
3. **https://lecturenotes.in/subject/22/microprocessor-and-microcontroller-MPMC**

Core 7: INTERNET OF THINGS

Preamble: Course provides a comprehensive idea about the IoT devices and Technology. This course also examines the knowledge and fundamentals of sensors, actuators and communication protocols. The student should be able to understand applications of ESP8266 Wifi Module. The goal is to develop a solid understanding in the field of designing IoT applications.

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
Part - III	Core-7	U21EL507	Internet of Things	70	05	-	4

Conduct hours per semester: 75
Conduct hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
Third	V	25	75	100

Course Outcomes (COs)

On successful completion of the course, the learners be able to

Co No.	Course Outcome	Knowledge Level (RBT)
1	get a clear idea about IoT Architecture and protocols & Challenges in IoT.	K1
2	get a clear idea about Arduino Uno Architecture and Embedded C programming language.	K2
3	get a clear idea about interfacing of Sensor & Actuators with Arduino.	K3
4	get a clear idea about wireless networking with ESP8266 WIFI module.	K4
5	use the gained knowledge in designing IoT applications using Cloud Platforms.	K5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO Mapping (Course Articulation Matrix)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	1	2	3	3
CO2	2	3	2	2	1	1	2
CO3	3	3	1	3	2	2	0
CO4	3	3	0	3	0	3	2
CO5	3	2	3	3	3	3	3
Total Contribution of COs to POs	14	14	09	12	08	12	10
Weighted Percentage of COs Contribution to POs	93.3	93.3	60	80	53.3	80	66.7

0 – Not Correlation 1 – Low 2 – Moderate 3 - High

COURSE CONTENT

UNIT-I Introduction to IoT (L-14Hrs + T – 1Hr)

Understanding IoT fundamentals, IoT Architecture and protocols, Various Platforms for IoT, Real time Examples of IoT, Overview of IoT components and IoT Communication Technologies, Challenges in IoT.

UNIT-II Arduino Simulation Environment (L-14Hrs + T – 1Hr)

Arduino Uno Architecture, Setup the IDE, Writing Arduino Software, Arduino Libraries, Basics of Embedded C programming for Arduino, Interfacing LED, push button and buzzer with Arduino, Interfacing Arduino with LCD.

UNIT-III Sensor & Actuators with Arduino (L-14Hrs + T – 1Hr)

Overview of Sensors working, Analog and Digital Sensors, Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino, Interfacing of Actuators with Arduino, Interfacing of Relay Switch and Servo Motor with Arduino.

UNIT-IV Basic Networking with ESP8266 WIFI Module (L-14Hrs + T – 1Hr)

Basics of Wireless Networking, Introduction to ESP8266 Wi-Fi Module, NodeMCU, Various Wi-Fi library, Web server- introduction, installation, configuration, Posting sensor(s) data to web server.

UNIT-V IoT Protocols and Cloud Platforms for IoT (L-14Hrs + T – 1Hr)

M2M vs IoT, Communication Protocols, Virtualization concepts and Cloud Architecture, Cloud computing, benefits, Cloud services -- SaaS, PaaS, IaaS, Cloud providers & offerings, Study of IoT Cloud platforms, Blynk App, ThingSpeak API and MQTT, Interfacing ESP8266 with Web services.

Tutorial Section

Unit	Topic	Hours
I	IoT Architecture and protocols	1
II	Interfacing LED, push button	1
III	Analog and Digital Sensors	1
IV	Introduction to ESP8266 Wi-Fi Module	1
V	Blynk App, ThingSpeak API	1

Text Books:

1. Marco Schwartz, “Internet of Things with ESP8266: Build amazing Internet of Things projects using the ESP8266 Wi-Fi chip”, Packt Publishing Limited, 2016.
2. Marco Schwartz, “Internet of Things with Arduino Cookbook”, Ingram short title, 2016
3. Adeel Javed, “Building Arduino Projects for the Internet of Things: Experiments with Real-World Applications”, Apress, 2016
4. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”.
5. Mark Wilkins, “Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud” Pearson Education, First Edition, 2019

Reference Books:

1. Michael Margolis, “Arduino Cookbook”, O′Reilly, Third Edition, 2020

Websites for Reference

1. https://www.meity.gov.in/sites/upload_files/dit/files/Draft-IoT-Policy%20%281%29.pdf
2. https://www.researchgate.net/figure/Growth-of-connected-devices-4_fig1_285593511

3. https://atmelcorporation.wordpress.com/2014/07/16/bi-intelligence-details-iot-enterprise-apps/
4. https://bridgera.com/the-future-gen-of-internet-iot-in-brief/
5. https://futureskills.nasscom.in/
6. https://www.toolbox.com/tech/iot/blogs/internet-of-things-the-bright-wave-of-the-future-121818
7. https://www.mondaq.com/india/telecoms-mobile-cable-communications/992586/internet-of-things-iot-policy-and-challenges-in-india
8. https://www.skillreporter.com/2019/12/news/other-minstries/ministry-approved-436-crore-for-developing-iot-ai-and-blockchain-skills-of-more-than-4-lakh-youth/
9. https://blog.eduonix.com/internet-of-things/top-10-popular-iot-development-tools/

Core - 8: MEDICAL ELECTRONICS

Preamble: The course provides an exposure on basics of human physiology and Bio Medical Instruments. It also aims to understand concepts and performance criterion for Patient Monitoring Systems. Students gain knowledge about the various recently developed diagnostic, assisting and therapeutic devices.

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
Part - III	Core-8	U21EL508	Medical Electronics	70	5	-	4

Conduct hours per semester: 75
Conduct hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
Third	V	25	75	100

Course Outcomes (COs)

On successful completion of the course, the learners be able to

Co No.	Course Outcome	Knowledge Level (RBT)
1	know the physiology of human body, Transducers, Electrodes, Bio Medical Instruments and Patient Monitoring systems.	K1
2	comprehend the concepts of physiology of human body, Transducers, Electrodes, Bio Medical Instruments and Patient Monitoring systems.	K2
3	apply the principles of transducers into Biomedical & Patient Monitoring systems	K3
4	correlate the significance of different Bio Medical Instruments, Transducers, Electrodes and also analyse the physiology of human body, Patient Monitoring Systems	K4
5	infer and evaluate the physiology of human body, Transducers, Electrodes, Bio Medical Instruments and Patient Monitoring systems.	K5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO Mapping (Course Articulation Matrix)

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	1	2	3	3
CO2	2	1	3	2	3	0	2
CO3	3	2	2	3	2	2	2
CO4	3	3	3	3	3	3	3
CO5	3	2	0	3	3	3	2
Total Contribution of COs to POs	14	11	11	12	13	11	12
Weighted Percentage of COs Contribution to POs	93.3	73.3	73.3	80	86.6	73.3	80

0 – Not Correlation 1 – Low 2 – Moderate 3 - High

COURSE CONTENT

UNIT I Physiology and Transducers (L - 14 Hrs+ T-1Hr)

Components of Man Instrument System – Resting and Action Potentials: Generation and Characteristics – Cardiovascular System – Heart sounds – Transducers: Principle – Active transducer: Piezoelectric transducer – Photoelectric transducer – Passive transducer: Capacitive transducer – Inductive transducer – Transducers for Biomedical applications – Bio-Signal Processing

UNIT II Biomedical Recorders and Electrodes (L - 14 Hrs+ T-1Hr)

Electrodes – Principle – Surface electrode – Needle electrode and Micro electrodes - ECG, PCG, EEG, EMG, ERG – Recording methods and typical waveforms

UNIT III Patient Monitoring Systems (L - 14 Hrs+ T-1Hr)

Measurement of Blood Pressure: Indirect Method – Measurement of Blood flow: Electromagnetic Blood flow meter – Ultrasonic Blood low meter - Plethysmography – Fingertip oximeter – ESR, GSR measurements – Audio meters – Components of ICU

UNIT IV Medical Imaging and Diagnostics (L - 14 Hrs+ T-1Hr)

X-Ray Machine – CT scanner – Magnetic Resonance Imaging (MRI) system – Properties of ultrasound – Ultra sonic imaging system – Echo-cardiograph – Colour Doppler – Endoscopy

UNIT V Assisting & Therapeutic Instruments (L - 14 Hrs+ T-1Hr)

Pacemakers – Comparison of Internal Pacemaker and External Pacemaker – Defibrillators – Surgical Diathermy – Short Wave Diathermy – Ultrasonic Diathermy – Biotelemetry – Components of Biotelemetry – Biotelemetry transmitter & Receiver – Applications of Telemetry in Patient care.

Tutorial Section

Unit	Topic	Hours
I	Photoelectric transducer	1
II	ECG	1
III	ESR, GSR measurements	1
IV	X-Ray Machine	1
V	Biotelemetry transmitter & Receiver	1

Text Books

1. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer "**Biomedical Instrumentation and Measurements"**, Second edition, PHI Learning Pvt. Ltd.
2. M.Arumugam**, "Bio-Medical Instrumentation",** Anuradha publications, 2017

Reference Books

1. Khandpur, R.S., "Handbook of Biomedical Instrumentation", Third Edition, TATA Mc Graw - Hill, New Delhi, 2014.
2. O.N. Pandey & Rakesh Kumar "Fundamentals of Biomedical Instrumentation", S.K. Kataria & Sons; 5th edition, Reprint 2020.
3. G.S.Sawhney "Biomedical Electronics and Instrumentation Made Easy" Dreamtech Press, 2021.

Websites

1. https://www.mathworks.com/discovery/biomedical-signal-processing.html
2. https://www.howequipmentworks.com/pulse_oximeter/
3. https://patient.info/doctor/pulse-oximetry

Core Lab 5: MICROPROCESSOR AND MICROCONTROLLER LAB

Preamble:

- To develop their knowledge on the architecture and the programming skills.
- This laboratory course provides hands-on experience to interface I/O devices

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
Part - III	Core Lab-5	U21EL5P5	Microprocessor and Microcontroller lab	-	-	90	3

Conduct hours per semester: 90

Conduct hours per week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
Third	V	40	60	100

Course Outcome

On successful completion of the course, the learners be able to

CO No.	Course Outcome	Knowledge Level (RBT)
1	apply the fundamentals of assembly level programming to implement programs on 8085 microprocessor.	K1, K2
2	able to Interfacing circuits with 8085 microprocessor.	K3
3	apply the fundamentals of assembly level programming of microcontroller.	K4
4	able to Interfacing circuits with 8051 microcontroller.	K5
5	design and Develop program for real time interfaces	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO Mapping (Course Articulation Matrix)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	0	2	3	2
CO2	2	3	3	1	3	0	1
CO3	3	3	3	3	2	2	3
CO4	3	3	3	2	3	3	2
CO5	3	2	2	3	3	3	3
Total Contribution of COs to POs	14	14	14	09	13	11	11
Weighted Percentage of COs Contribution to POs	93.3	93.3	93.3	60	86.6	73.3	73.3

0 – Not Correlation 1 – Low 2 – Moderate 3 - High

List of Experiments

(Minimum 16 Experiments to be carried out)

A. Microprocessor Lab (any 8 experiments)

1. Program for 8 bit arithmetic operations
2. Program for Square and Square root of a number
3. Program for 1's complement and 2's complement of 8 bit
4. Program for Sorting and Searching
5. Program for Smallest and Largest number in an array.
6. Program for Fibonacci series, Factorial of a number.
7. Code conversion ASCII to Binary, Binary to ASCII
8. Rolling display
9. Program to display Time(Hours and Minutes)
10. Interfacing Traffic light controller
11. Interfacing Stepper motor control
12. Interfacing Matrix Keyboard
13. Interfacing A.D.C

14. Study of 8255 chip and generation of Square wave

B. Microcontroller 8051 Lab (Any 8 Experiments)

1. 8 bit arithmetic operations
2. 8 bit Program for 1’s complement and 2’s complement
3. Logical Operations – AND, OR, NOT
4. Ascending Order.
5. Descending Order
6. Block data transfer.
7. Blinking, shifting and rotating of LED's using a Port
8. Interfacing with LCD.
9. Interfacing with Matrix Keypad.
10. Triangular wave generator
11. Interfacing with ADC.
12. Interfacing with DAC.
13. Digital Clock.
14. Interfacing with Stepper Motor.

Core Lab 6: ELECTRONIC SYSTEM DESIGN LAB

Preamble:

- To Familiarize the students with good hardware design methods
- To provide the basics skills required to understand, develop & design various electronic systems
- To make the students to design and implement electronic system independently or in a team

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
Part - III	Core Lab-6	U21EL5P6	Electronic System Design Lab	-	-	90	3

Conduct hours per semester: 90

Conduct hours per week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
Third	V	40	60	100

Course Outcome

On successful completion of the course, the learners be able to

CO No.	Course Outcome	Knowledge Level (RBT)
1	learn the basics of electronics components to design the System	**K1, K2**
2	apply the principles of electronic system to design various circuits	**K3**
3	analyze the key stages in development of the System	**K4**
4	extend the design ideas for Mini projects/ Major projects	**K5**
5	prepare the technical report on the experiments carried.	**K6**

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO Mapping (Course Articulation Matrix)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	1	1	3	2
CO2	2	3	2	2	3	1	2
CO3	3	3	2	3	0	2	3
CO4	3	3	3	3	2	3	0
CO5	3	2	1	3	3	3	3
Total Contribution of COs to POs	14	14	11	12	09	12	10
Weighted Percentage of COs Contribution to POs	93.3	93.3	73.3	80	60	80	66.7

0 – Not Correlation 1 – Low 2 – Moderate 3 - High

List of Experiments

(Minimum 12 Experiments to be carried out)

1. Design and implementation of switching power supply
2. Design and implementation of 1.5 to 12 V power supply
3. Design and implementation of Burglar alarm using LDR
4. Design and implementation of Voltage regulator
5. Design and implementation of Temperature switch using Thermistor
6. Design and implementation of Light sensitive switch using Photo diode
7. Design and implementation of Audio amplifier using LM 380
8. Design and implementation of wire break alarm
9. Design and implementation of Decade counter
10. Design and implementation of Seven segment decoder
11. Design and implementation of Logic probe
12. Design and implementation of Light dimmer using Triac
13. Design and implementation of Automatic Street light controller
14. Design and implementation of Temperature controller using LM35
15. Design and implementation of smoke detector

16. Design and implementation of speed control of DC motor
17. Design and implementation of speed control of AC motor
18. Design and implementation of Automatic Battery charger
19. Design and implementation of Heart rate monitor using LM 358

Skill Enhancement-1: WOMEN STUDIES

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
Part – IV	Skill Enhancement1	U21SE5S1	Women Studies	30	-	-	2

Contact hours per Semester: 30
Contact hours per week: 2

Year	Semester	Internal Marks	External Marks	Total Marks
II	FIFTH	-	50	50

Preamble

This is an introductory course that emphasizes the roles of women, their experiences and contributions to society and enables students to analyze contemporary issues from feminist perspective

Course Outcomes

On successful completion of the Course, the learners will be able to

S. No.	Course Outcome	Knowledge Level
1.	remember the need for gender sensitisation , recall the role of Women as individuals in families and societies, recognise matriarchy and matrilineal societies. list out Women's movements and woman achievers, identify the role of women in National development, identify methods to promote inclusion of women in development of all sectors	K1
2.	understand the terms and concepts used in women's studies, recognize the need for gender sensitization, discuss about domestic violence against women, illustrate the representation of women in media/sports/politics/arts and literature, demonstrate how gender has been socially constructed and maintained through a variety of institutions	K2
3.	apply concepts and theories of Women's Studies to life experiences and processes, provide guidance to ignorant women on women's rights, investigate gender issues and gender violence leashed out on women, review the life of women achievers	K3
4.	analyse gender roles in domestic personal sphere and social spheres, explore the socio-cultural, socio-political and economic factors that deter women's talent, analyse socio-political systems and contemporary issues from feminist perspective	K4

5.	evaluate the scope, importance and challenges of Women's Studies, appraise the role of women in rural and community development, assess the extent to which women have contributed to preservation of environment and natural resources and in turn to national development, appreciate the life of women achievers, reflect on the role of women in family and society	K5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

COURSE CONTENT

WOMEN STUDIES

Unit I: Introduction to women's studies (T-6 Hrs)

Definition, need, scope, importance and challenges of Women's Studies- Emergence of Women's studies as an academic discipline in India – Need for gender sensitisation - Women as individuals in families and societies- Matriarchy and matrilineal societies. Women's movements - global and local.

Unit II: Role of women in family (T-6 Hrs)

Study of the evolution of women's role – Women as individuals in families-Gender roles in domestic/personal sphere- Women's roles, aspirations and familial expectations on women - Foeticide, Female infanticide, Sex selective abortion, Domestic violence, Gender issues, Gender violence, Maternal mortality rate, Property rights, Reproductive rights – Women's health and nutrition

Unit III: Role of women in society (T-6 Hrs)

Gender roles in social spheres- Choice of profession - Self , Family and Societal pressures, Decision making/ Leadership roles- myths and misconceptions- roles expected from women – stereotyping – Representation in media / politics / arts and literature / sports

Unit IV: Against all odds- Women achievers (T-6 Hrs)

Socio-cultural, socio-political and economic factors that deter women's talent- Life narratives of women achievers- Savitri Bhai Phule, Dr.Muthu Lakshmi Reddy, Kiran Mazumdhar Shah, Kalpana Chawla, Saina Nehwal, Sania Mirza, Deepika Palikkal, Mary Kom, P T Usha, Smriti Mandanna, Arundhati Roy, Vandana Siva, Kamala Das, Indira Goswami, Amrita Pretham, Anita Desai, Jhumpa Lahiri, Kiran Desai, Shashi Deshpande.

Unit V: Role of women in National Development: (T-6 Hrs)

Role of women in rural and community development- community bio-diversity conservation –gender and Agro biodiversity-role of women in seed preservation- sustainable development- Joint forest management,- Chipko movement, Narmada Bachao Andolan—India's - Neem patent victory-Living Democracy Movement for reclaiming life's diversity and freedom

Text books

1. Maithreyi Krishna Raj. (1986). "Women Studies in India: Some Perspectives". Popular Prakasham, Bombay.
2. Sharmila Rege, (Ed.). (2003). "Sociology of Gender: The Challenge of Feminist Sociological Knowledge". Sage Publications, New Delhi

3. Veena Majumdar. (1974). “Report on the committee on the Status of Women: Towards Equality”. Journal of Women Studies.
4. Kadambari,V. 2009. Gender Studies: A Primer. Chennai: RJYND
5. Devaki Jain and Pam Rajput (Ed). (2003). “Narratives from the Women‟s Studies Family: Recreating Knowledge, Sage, and New Delhi.
6. M.S.Swaminathan. (1998).“Gender Dimensions in Biodiversity Management”. Konark publishers pvt ltd, New Delhi.

References

1. Amy S. Wharton. (2005). “The Sociology of Gender: An Introduction to Theory and Research”. (KeyThemes in Sociology) Blackwell Publishing, UK, Indian Reprint,Kilaso Books, New Delhi
2. Jasbir Jain (Ed). (2005). “Women in Patriarchy: Cross Cultural”. Rawat Publications, Jaipur.
3. Lerner, Gerda. (1986). “The Creation of Patriarchy”. Oxford University Press, New Delhi.
4. Mala Khullar, (Ed). (2005). “Writing the Women‟s Movement: A Reader”. Zubaan, Kali for Women, New Delhi.
5. Mies, Maria. (1980). “Indian Women and Patriarchy”. Concept Publishing Company, New Delhi.
6. Promilla Kapur (Ed), Empowering Indian Women, Publication Division, Government of India, New Delhi, 20
7. Mitchell, J. 1975. Women in a Man Made World. Chicago: Rand McNally & Co
8. Putnam Tong, Rosemarie. 2013. Feminist Thought: A More Comprehensive Introduction. USA: Westview.
9. Russell, Bertrand. 1936. Marriage and Morals. London: Bantam.
10. Smith, Bonnie. 2013. Women’s Studies: The Basics. London: Routledge
11. Drinkwater, Barabara, Ed. 2000. Women in Sport. Oxford: Blackwell Science
12. Spence, Jean and Sarah Jane et al. 2010. Women Education and Agency 1600-2000. New York: Routledge Publishing House.
13. Nancy. 2011. Feminism and Science. Indianapolis: Indiana University Press.
14. Tharu, Susie and K. Lalitha (ed). 1991 &1993. Women Writing in India, 2 Vols. New Delhi: Oxford University Press.
15. P.K.Rao. (2000) “Sustainable Development – Economics and Policy”. Blackwell, New Delhi.
16. Radha Kumar, (1993). “The History of Doing”. Kali for Women, New Delhi.
17. Ronnie Vernooy, (Ed). (2006). “Social and gender Analysis Natural Resource Management: Learnning studies and lessons from Aisa”. Sage, New Delhi.
18. Swarup, Hemlata and Rajput, Pam. (2000). Gender Dimensions of Environmental and Development Debate: The Indian Experience”. In Sturat S.Nagel, (ed). “India‟s Development and Public Policy”. Ashgate, Burlington.
19. Venkateshwara, Sandhay. (1995). “Environment, Development and the Gender Gap”SagePublications,NewDelhi.

Web references

1.https://r.search.yahoo.com/_ylt=AwrxhWjc7_9geRUAlADnHgx.;_ylu=Y29sbwMEcG9zAzUEdnRpZAMEc2VjA3Ny/RV=2/RE=1627414620/RO=10/RU=https%3a%2f%2fin.sagepub.com%2fen-in%2fsas%2findian-journal-of-gender-studies%2fjournal200917/RK=2/RS=wGNZp8L5sqXOSojTzCefS4hzShA-

2.https://r.search.yahoo.com/_ylt=Awrx5kom8f9gJDAAXC_nHgx.;_ylu=Y29sbwMEcG9zAzEEdnRpZAMEc2VjA3Ny/RV=2/RE=1627414951/RO=10/RU=https%3a%2f%2fwgs.fas.harvard.edu%2fpast-thesis-topics/RK=2/RS=cjxRQNT0UmGS1Fia5z9Er8a8P.I-

Proficiency Enhancement Course (Self Study Course):

GENERAL STUDIES

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
PART-V	Proficiency Enhancement Courses - Self-Study Course	-	General Studies	-	-	-	1

Year	Semester	
I to III Year	I to VI Semester	Completion Only

Preamble:

The Course is designed to provide Students basic knowledge about General Science, History and Culture of India & Tamil Nadu, Geography of India & Tamil Nadu, Indian Polity, Economy and Tamil Nadu Administration. It is designed to make the learners well versed in General knowledge, Current Events, Quantitative Aptitude and Mental Ability. Main objective of the Course is to facilitate students appearing for Competitive exams to come out with flying colours.

Course outcomes

Upon completion of the Course, the learner will be able to

S.No.	Course Outcomes	Knowledge level
CO1	recall the basic principles and laws in Science, recap the important events in history, remember the geography and culture of India and Tamil Nadu, recapitulate the events in Indian polity and Tamil Nadu administration, remember current affairs, geographical land marks, welfare schemes by the Government, scientific inventions and problems in public delivery system	K1
CO2	comprehend the basic principles and laws in Science, demonstrate the important events in history, reproduce the geography and culture of India and Tamil Nadu, the events in Indian polity and Tamil Nadu administration, Public Corruption and Lokpal & Lok ayuktha act, Transport and communication system in India, Industrial growth in T.N. ,unemployment and poverty eradication issues	K2
CO3	solve problems based on Percentage, Ratio and Proportion Time and Work, Simple interest, Compound interest, Area, Volume related problems and exhibit mathematical skills	K3

CO4	analyse and answer questions based on logical, visual and alpha numeric reasoning	K4
CO5	evaluate the constitution of India, Indian Economy, Tamil Nadu administration, social geography of India and Tamil Nadu, political system in India, pollution and its control measures	K5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

COURSE CONTENT

UNIT-I: General Science

i. General Scientific Laws – Mechanics - Properties of Matter, Force, Motion and Energy -Electricity and Magnetism, Light, Sound, Heat, Nuclear Physics, Electronics and Communications, solar energy

ii. Atomic structure, Elements and Compounds, Acids, Bases, Salts, Petroleum Products, Fertilizers, Pesticides, Energy resources

iii. Classification of Living Organisms, Evolution, Genetics, Physiology, Nutrition, Health and Hygiene, Diseases

iv. Environment and Ecology- Biosphere, Conservation of biodiversity- Biosphere Reserves of India, Sanctuaries and National parks, Environmental pollution, causes and control measures, alternate sources of energy

UNIT-II: General knowledge, Current Events, Quantitative Aptitude and Mental Ability

i. Latest Diary of Events - National symbols - Profile of States and Union territories, Eminent persons and places in news – Sports - Books and Authors - Prominent Personalities in various spheres – Arts, Science, Literature and awards

ii. Political parties and Political system in India – Public awareness and General administration - Welfare oriented Government Schemes and their utility, Problems in Public Delivery Systems, Public Corruption and Lokpal & Lokayuktha act

iii. Geographical landmarks - Current socio - economic issues - Latest inventions in Science and Technology. Industrial growth in India and Tamilnadu

iv. Quantitative Aptitude and Mental Ability- Simplification – Percentage - Ratio and Proportion- Time and Work - Simple interest - Compound interest - Area - Volume - Logical Reasoning -Visual Reasoning – Alpha numeric Reasoning – Number Series

UNIT-III: Geography of India & Tamil Nadu

i. Location – Physical features - Monsoon, Rainfall, Weather and Climate - Water Resources-Rivers in India - Soil, Minerals and Natural Resources - Forest and Wildlife – Agricultural pattern
ii. Transport – Communication
iii. Social Geography –Population, Census, poverty eradication and unemployment
iv. Natural calamity – Disaster Management – Environmental pollution, Climate change, pandemics in history – Green energy initiatives

UNIT–IV: History and Culture of India & Tamil Nadu

i. Ancient India: Indus Valley Civilization - The Maurian empire- Age of the Guptas-vardhana empire- Nalanda university
ii. Medieval India: The Delhi Sultanate, Mughals and Marathas - Age of Vijayanagara and Bahmani Kingdoms –South Indian History.
iii. National: Early uprising against British rule – sepoy mutiny Renaissance, Indian National Congress - Emergence of leaders- Gandhian Era
iv. Tamil Nadu: History & Culture, Socio-Political Movements

UNIT-V: Indian Polity, Economy and Tamil Nadu Administration

i. Constitution of India - Preamble to the Constitution – Salient features of the Constitution - Citizenship, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy
ii. Union Executive, Union Legislature (Parliament) – State Executive, State Legislature – Local Governments, Panchayat Raj - Spirit of Federalism - Centre - State Relationships Election – Judiciary in India – Rule of Law
iii. Indian Economy – Five-year plan models – an assessment – Planning Commission and Niti Ayog - Reserve Bank of India – Fiscal Policy and Monetary Policy – Finance Commission – Goods and Services Tax
iv. Governance in India and Development-Administration in Tamil Nadu

Text Books:

1. TNSCERT Books (Science and Social) from Std VI -X
2. Manorama year Book (Tamil)
3. Arihant General Knowledge,2022-Manohar Pandey

VI SEMESTER

Core-09: ADVANCED MICROCONTROLLER AND RTOS

Preamble: Course provides a comprehensive idea about the Advanced Microcontroller and RTOs. The student should be able to understand applications of ATmega328P and RTOs. The goal is to develop a solid understanding to develop advanced microcontroller-based system.

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
Part - III	Core-09	U21EL609	Advanced Microcontroller and RTOs	70	05	-	4

Conduct hours per semester: 75
Conduct hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
Third	VI	25	75	100

Course Outcomes (COs)

On successful completion of the course, the learners be able to

Co No.	Course Outcome	Knowledge Level (RBT)
1	get a clear idea about Architecture and Pin Configuration of ATmega328P.	K1
2	understand concept of AVR CPU Core & AVR Memories of ATmega328P.	K2
3	use the concept of Synchronous Peripheral interfaces (SPI) to communicate with peripherals.	K3
4	analyze the function of Interrupt, I/O Ports, System Clock, System Control & Reset techniques.	K4
5	evaluate the working of ATmega328P, RTOs and various API calls.	K5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO Mapping (Course Articulation Matrix)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	3	2	3	2	3
CO2	2	3	3	3	2	3	2
CO3	3	2	2	0	2	2	2
CO4	2	2	2	3	2	0	2
CO5	2	2	2	1	2	2	3
Total Contribution of COs to POs	11	11	12	09	11	09	12
Weighted Percentage of COs Contribution to POs	73.3	73.3	80	60	73.3	60	80

0 – Not Correlation 1 – Low 2 – Moderate 3 - High

COURSE CONTENT

UNIT-I Introduction to the ATmega328P (L-14Hrs + T – 1Hr)

Introduction to the ATmega328P: Features of ATmega328P, Pin Configurations - Pin Descriptions, Block Diagram - Block Diagram of the AVR Architecture, ALU, Status Register, General Purpose Register File - The X-register, Y-register, and Z-register, Stack Pointer - SPH and SPL, Instruction Execution Timing, Reset and Interrupt Handling - Interrupt Response Time

UNIT-II AVR Memories and Registers (L-14Hrs + T – 1Hr)

In-System Reprogrammable Flash Program Memory, SRAM Data Memory - Data Memory Access Times, EEPROM Data Memory - EEPROM Read/Write Access, Preventing EEPROM Corruption, I/O Memory - General Purpose I/O Registers, Register Description - EEARH and EEARL – The EEPROM Address Register, EEDR – The EEPROM Data Register, EECR – The EEPROM Control Register, GPIOR

UNIT-III System Clock, System Control & Reset (L-14Hrs + T – 1Hr)

Clock Systems and their Distribution, Clock Sources, Low Power Crystal Oscillator, Full Swing Crystal Oscillator, Low Frequency Crystal Oscillator, Calibrated Internal RC Oscillator, 128 kHz Internal Oscillator, External Clock, Clock Output Buffer, Timer/Counter Oscillator, System Clock Prescaler, Register Description – OSCCAL, CLKPR, System Control and Reset, Interrupts - Interrupt Vectors in ATmega328P, Register Description –

Moving Interrupts Between Application and Boot Space, MCUCR, External Interrupts – EICRA, EIMSK, EIFR, PCICR, PCIFR, PCMSK2, PCMSK1, PCMSK0.

UNIT-IV I/O-Ports & Timer/Counter with PWM (L-14Hrs + T – 1Hr)

I/O Pin Equivalent Schematic, Ports as General Digital I/O, Alternate Port Functions of B, C, D, Register Description – MCUCR, PORTB, DDRB, PINB, PORTC, DDRC, PINC, PORTD, DDRD, PIND, 8-bit, 16-bit Timer/Counter with PWM: Features, 8-bit, 16-bit Timer/Counter Block Diagram, Modes of Operation, Timer/Counter Timing Diagrams, Register Description, SPI – Serial Peripheral Interface, USART0, USART in SPI Mode.

UNIT-V Real Time Operating Systems (RTOS) (L-14Hrs + T – 1Hr)

Threads, FreeRTOS Configuration, Synchronization, Interrupt Handlers, SPI, FatFS, FreeRTOS API.

Tutorial Section

Unit	Topic	Hours
I	Introduction to the ATmega328P	1
II	In-System Reprogrammable Flash Program Memory	1
III	System Clock Prescaler	1
IV	SPI – Serial Peripheral Interface	1
V	FreeRTOS Configuration	1

Text Books:

1. "ATmega328P_Datasheet" https://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-7810-Automotive-Microcontrollers-ATmega328P_Datasheet.pdf (Unit I - Unit IV)
2. Geoffrey Brown, "Discovering the STM32 Microcontroller", Indiana University, June 5, 2016 (Unit - V) https://legacy.cs.indiana.edu/~geobrown/book.pdf

Reference Books:

1. Thomas Grace "Programming & Interfacing Atmel Avr Microcontrollers", engage Learning, Inc; New edition (29 July 2015)

Core - 10: INDUSTRIAL ELECTRONICS

Preamble: This course is an introductory exposition of the principles and applications of Power Semiconductor devices and PLCs. This course is to acquaint the students with industrial circuits and their applications.

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
Part - III	Core-10	U21EL610	Industrial Electronics	70	5	-	4

Conduct hours per semester: 75
Conduct hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
Third	VI	25	75	100

Course Outcomes (COs)

On successful completion of the course, the learners be able to

Co No.	Course Outcome	Knowledge Level (RBT)
1	learn about the electronic devices available in Industry	K1
2	comprehend the concepts of industrial circuits	K2
3	use the concepts of electronic devices to analyse the circuits available in industry	K3, K4
4	infer and evaluate the significance of different power semiconductor devices, converters and PLCs used	K5
5	develop the circuits designing skills related to the Industrial Electronics	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO Mapping (Course Articulation Matrix)

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	3	2	3	2	3
CO2	2	3	3	3	2	3	2
CO3	3	2	2	1	2	2	2
CO4	2	2	2	3	2	0	2
CO5	2	2	2	0	2	2	3
Total Contribution of COs to POs	11	11	12	09	11	09	12
Weighted Percentage of COs Contribution to POs	73.3	73.3	80	60	73.3	60	80

0 – Not Correlation 1 – Low 2 – Moderate 3 - High

COURSE CONTENT

UNIT I Power Semiconductor Diodes and Transistors (L-14Hrs + T – 1Hr)

Power diodes – Structure – Characteristics – Power BJT – Steady state characteristics – Switching characteristics – Safe Operating Area (SOA)

Power MOSFET – Static characteristics – Switching characteristics – Comparison between Power MOSFET with BJT– IGBT Structure – Characteristics – Switching Characteristics.

UNIT II Thyristors (L-14Hrs + T – 1Hr)

Silicon Controlled Rectifier (SCR): Structure – VI characteristics – Turn - On and Turn - Off Characteristics – Thyristor Ratings – Gate triggering circuits – Resistance and Resistance Capacitance triggering – UJT triggering – Commutation of a thyristor – Thyristor Protection circuits – Characteristics and working of Diac – Triac.

UNIT 3 Choppers and Inverters (L-14Hrs + T – 1Hr)

Choppers: Principle of chopper operation – Step-up chopper – Step-down chopper – Morgan Chopper

Inverters: Principle of working – Series Inverter – Parallel Inverter – Bridge Inverter – McMurray Inverter

UNIT IV Programmable Logic Controllers (PLC) (L-14Hrs + T – 1Hr)

Programmable Logic Controllers (PLCs): Introduction – Block diagram of a PLC – Processor – memory – Input and Output modules – Analog and Digital modules – Logic functions – Advantages & Disadvantages – Applications – Relays and their characteristics: Electromagnetic Relays – Solid State Relays – Reed Relays – Time delay relays

UNIT V Applications (L-14Hrs + T – 1Hr)

Induction heating – Dielectric heating – Switched mode power supply (SMPS) – Uninterrupted Power Supply (UPS) – Static Switch – Fan regulator – Automatic Street Light Controller – Automatic Battery Charger – Emergency light – Bar code Reader.

Tutorial Section

Unit	Topic	Hours
I	Static characteristics Power MOSFET	1
II	VI characteristics SCR	1
III	Inverters	1
IV	Electromagnetic Relays	1
V	Automatic Street Light Controller	1

Text Books

1. S K Bhattacharya, S Chatterjee "Industrial Electronics and control", 22nd Reprint 2015, McGraw Hill Education (India) Private Limited.
2. Biswanth Paul, "Industrial Electronics and Control including PLC", Third Edition, PHI Learning Pvt Ltd, 2014.

Reference Books

1. P S Bimbhra, "Power Electronics", Fifth Edition, Khanna Publishers, 2018.
2. A. K. Vanwasi, D.P. Joshi "Industrial Electronics and control", First Edition, Khanna Publishers,2015.
3. Harish C. Rai, "Industrial and Power Electronics", 10th Edition, Umesh Publications, New Delhi.
4. P.Gnanambokai, M. Natarajan " Industrial Electronics", N.V Publications.

Handbooks

1. **PLC handbook by FESTO**
2. **PLC** handbook by Automation direct

Websites

1. https://instrumentationtools.blogspot.com/2019/03/plc-study-material.html
2. https://www.studocu.com/in/document/kalinga-institute-of-industrial-technology/industrial-automation-control/plc-basics-lecture-notes-8/18045580
3. https://www.electrical4u.com/programmable-logic-controllers/

Core: 11 ROBOTICS AND AUTOMOTIVE ELECTRONICS

Preamble: This course helps the student to basic idea of Robots. Students are introduced to the basic design consideration of robots. Concepts like trajectory planning and obstacle avoidance and kinematics of robots are introduced. Discussion on various mobile robots and robotic manipulators are also included as part of the course to get an overall idea on robotics.

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
Part - III	Core - 11	U21EL611	Robotics and Automotive Electronics	70	5	-	4

Contact hours per semester: 75

Contact hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
Third	VI	25	75	100

Course Outcomes (COs)

On successful completion of the course, the learners be able to

CO No.	Course Outcome	Knowledge Level (RBT)
CO1	understand the concept of Robotics and Automotive Electronics systems	K1
CO2	acquire knowledge in different Robotics and Automotive Electronics system controls	K2
CO3	use the concept of robotics end effectors to analyze the Robotic systems	K3
CO4	study the different type of sensors used in Robotics and Automotive Electronics systems	K4
CO5	**a**dequate knowledge in Robotics and Automotive Electronics	K5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO Mapping (Course Articulation Matrix)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	0	1	2	2	2	1	3
CO2	2	3	3	3	1	1	1
CO3	2	3	2	3	1	1	1
CO4	2	3	3	2	1	1	1
CO5	2	3	3	2	1	1	1
Total Contribution of COs to POs	08	13	13	12	06	05	07
Weighted Percentage of COs Contribution to POs	53	86.7	86.7	80	40	33.3	46.6

0 – Not Correlation 1 – Low 2 – Moderate 3 - High

COURSE CONTENT

UNIT I INTRODUCTION (L-11Hrs + T – 1Hr)

Laws of robotics – Robot definitions – Robotics systems and robot anatomy – Robot actuators: Pneumatic power drives – Hydraulic systems – DC and AC motors.

UNIT II ROBOT CONTROLLERS (L-13 Hrs + T – 1Hr)

Control systems – Types of robot controls – Specifications of robots – Robotic technology – Safety measures in robotics.

UNIT III ROBOT END EFFECTORS (L-14Hrs + T – 1Hr)

Classification of End effectors – Drive system for grippers – Magnetic grippers – Vacuum grippers – Adhesive grippers – Hooks, Scoops and other miscellaneous devices.

UNIT IV ROBOT SENSORS (L-16Hrs + T – 1Hr)

Artificial Intelligence – Need for sensing systems – Sensory devices – Types of sensors: Contact, Touch, Position and displacement, Potentiometers, LVDT, Range Imaging sensors – Electro optical imaging sensors.

UNIT V ROBOT VISION SYSTEM (L-16Hrs+T - 1Hr)

Machine vision system functions – Low level vision – Vision cameras – Analog to digital conversion – Image storage – Noise reduction – Enhancement – Applications of robot vision system.

Tutorial Section

Unit	Topic	Hours
I	Robotics systems and robot anatomy	1
II	Types of robot controls	1
III	Classification of End effectors	1
IV	Range Imaging sensors	1
V	Vision cameras	1

Text Book

1. S.R.DEB, S.DEB, "Robotics Technology and Flexible Automation", Second Edition, McGraw Hill, New Delhi, Fourth reprint 2012.

Reference Book:

1. Dr.K.C.jain and Dr.L.N.Agarwal, "Robotics Principles and Practice", Khanna Publishers
2. Milell P.Groover, "Industrial Robotics – Technology, Programming and Applications", McGrawHill, New Delhi, 1986

Website Reference:

1. **https://www.ieee-ras.org/**
2. **https://www.wonikrobotics.com/**

Core Lab 7: ADVANCED MICROCONTROLLER & EMBEDDED C - LAB

Preamble:

- To develop their knowledge on the architecture and the programming skills.
- This laboratory course provides hands-on experience to interface I/O devices

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
Part - III	Core Lab-7	U21EL6P7	Advanced Microcontroller & Embedded C - Lab	-	-	60	3

Conduct hours per semester: 60
Conduct hours per week: 4

Year	Semester	Internal Marks	External Marks	Total Marks
Third	VI	40	60	100

Course Outcome

On successful completion of the course, the learners be able to

CO No.	Course Outcome	Knowledge Level (RBT)
1	understanding various Pin Configurations of Arduino Board and its use cases	K1,K2
2	apply various commonly used Sensors and Actuators with Arduino Board	K3
3	analyze the fundamentals of C Programming or Micropython to implement programs on Arduino Board	K4
4	evaluate the concepts related to interface circuits with Arduino Board	K5
5	design and Develop program for real time scenarios	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO Mapping (Course Articulation Matrix)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	1	2	3	3
CO2	2	3	2	2	3	2	2
CO3	3	2	3	0	2	2	3
CO4	2	3	2	3	3	3	3
CO5	2	2	2	2	3	2	2
Total Contribution of COs to POs	12	13	12	12	13	12	13
Weighted Percentage of COs Contribution to POs	80	86.7	80	80	86.7	80	86.7

0 – Not Correlation 1 – Low 2 – Moderate 3 - High

List of Experiments

(Minimum 10 Experiments to be carried out)

1. Digital I/O with Arduino/NodeMCU
2. Serial I/O with Arduino using I^2C MLX90614 / ISB-TS45D
3. Analog I/O with Arduino
4. DC motor control with Arduino using L298D/N / L293D/N
5. PWM with Arduino
6. Light Sensor with Arduino
7. LCD Interfacing with Arduino
8. Interrupts with Arduino
9. Obstacle Sensor Interfacing with Arduino
10. Air Pollution Sensor Interfacing with Arduino
11. Smoke Sensor Interfacing with Arduino
12. Heart Beat Sensor Interfacing with Arduino
13. DHT11 Sensor Interfacing with NodeMCU and uploading data to Cloud
14. Home Automation using NodeMCU

References:

1. Michael Margolis, “Arduino Cookbook”, O′Reilly, Third Edition, 2020
2. https://pdfcoffee.com/download/arduino-lab-manualpdf-pdf-free.html?reader=1
3. https://researchdesignlab.com/projects/Arduino%20experiments.pdf

Core Lab 8: POWER ELECTRONICS AND MEASUREMENTS LAB

Preamble:

- To provide the students a deep insight in to the working of different switching devices with respect to their characteristics
- To make the students to design triggering circuits of SCR and Snubber circuit

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
Part - III	Core Lab-8	U21EL6P8	Power Electronics and Measurements Lab	-	-	60	3

Conduct hours per semester: 60

Conduct hours per week: 4

Year	Semester	Internal Marks	External Marks	Total Marks
Third	VI	40	60	100

Course Outcome

On successful completion of the course, the learners be able to

CO No.	Course Outcome	Knowledge Level (RBT)
1	deep understanding about different instrumentation devices & ability to express characteristics of SCR, DIAC, TRIAC, MOSFET and IGBT	**K1, K2**
2	develop an ability to use measuring instruments and AC and DC bridges for measurements	**K3**
3	apply the concept of power electronic converters in power control applications	**K4**
4	analyze different converters & control with their applications	**K5**
5	ability to design snubber & triggering circuits and prepare the technical report on the experiments carried	**K6**

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO Mapping (Course Articulation Matrix)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	1	2	3	3
CO2	2	3	3	2	3	1	2
CO3	3	3	3	3	2	2	3
CO4	3	3	3	3	3	3	3
CO5	3	2	2	3	3	3	3
Total Contribution of COs to POs	14	14	14	12	13	12	14
Weighted Percentage of COs Contribution to POs	93.3	93.3	93.3	80	86.6	80	93.3

0 – Not Correlation 1 – Low 2 – Moderate 3 - High

A. Power Electronics Lab Practical

List of Experiments
(Minimum 6 Experiments to be carried out)

1. Study of VI Characteristics of SCR
2. Study of VI Characteristics of TRIAC
3. Study of VI Characteristics of Power MOSFET
4. Study of VI Characteristics of IGBT
5. R Triggering for Thyristors
6. R C Triggering for Thyristors
7. Design of Snubber circuit
8. Single phase AC voltage controller
9. DC motor controller
10. Single phase half wave rectifier using SCR

B. Measurements Lab Practical

List of Experiments
(Minimum 6 Experiments to be carried out)

1. Measurement of resistance using Wheatstone bridge
2. Measurement of resistance using Kelvin double bridge
3. Measurement of inductance using Maxwell bridge
4. Measurement of capacitance using Schering bridge
5. Study the characteristics of LVDT
6. Displacement meter using strain gauge
7. Transducer Applications and Measurement
8. Extension of range of PMMC meter
9. Current Measurement using sensors
10. Measurement of temperature by thermistor

Major Group Project & Viva Voce

Preamble: To develop skills to formulate a technical project and to provide guidance on the various tasks of the project and standard procedures. To teach use of new tools, algorithms and techniques required to carry out the projects and to provide guidance on the various procedures for validation of the product and analyze the cost effectiveness. And also guidelines provided to prepare technical report of the project.

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
Part - III	**Major Group Project & Viva Voce**	U21EL6MP	**Major Group Project & Viva Voce**	-	0	75	6

Conduct hours per semester: 75
Conduct hours per week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
Third	VI	40	60	100

Course Outcomes (COs)

On successful completion of course, the leaner should be able to

Co No.	Course Outcome	Knowledge Level (RBT)
1	formulate a real world problem, identify the requirement and develop the design solutions.	K1,K2
2	identify technical ideas, strategies and methodologies.	K2
3	utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.	K3,K4
4	perform test and validate through conformance of the developed prototype and analysis the costeffectiveness.	K4,K5
5	explain the acquired knowledge through preparation of report and oral presentations.	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO Mapping (Course Articulation Matrix)

Pos / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	2	2	2	3
CO2	2	3	3	3	2	3	3
CO3	3	2	2	2	3	2	3
CO4	2	3	3	3	3	3	2
CO5	3	3	2	2	3	2	3
Total Contribution of COs to POs	13	14	13	12	13	12	14
Weighted Percentage of COs Contribution to POs	86.6	93.3	86.6	80	86.6	80	93.3

0 – Not Correlation 1 – Low 2 – Moderate 3 - High

COURSE CONTENT

Major Project shall be a group activity with a maximum of 4 students in a group. Students are advised to select topics of their own interest in hardware and develop their hardware skills by designing a circuit of their own. Periodical assessment may be done toevaluate their skills.

Skill Enhancement-2: SOLAR PHOTOVOLTAIC SYSTEM DESIGN

Preamble: Course provides a comprehensive idea about the Solar Photovoltaic System Design. This course also examines the knowledge and fundamentals of Construction & Working of Photo Voltaic.

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
Part - IV	Skill Enhancement-2	U21EL6S2	Solar Photovoltaic System Design	28	2	-	2

Conduct hours per semester: 30
Conduct hours per week: 2

Year	Semester	Internal Marks	External Marks	Total Marks
Third	VI	00	50	50

Course Outcomes (COs)

On successful completion of the course, the learners be able to

Co No.	Course Outcome	Knowledge Level (RBT)
1	get a clear idea about Solar Photovoltaic System Design	K1
2	understand the concept of Photovoltaic Cell	K2
3	implement the Photovoltaic Cell in electronics circuits	K3
4	analyze the installation methods and maintenance of Solar Panel	K4
5	use the gained knowledge in designing Solar Photovoltaic System Design for a given load requirements	K5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO Mapping (Course Articulation Matrix)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	2	3	2	3	2	3
CO2	2	3	3	3	2	3	2
CO3	3	2	2	1	2	2	2
CO4	2	2	2	3	2	0	2
CO5	2	2	2	0	2	2	3
Total Contribution of COs to POs	10	11	12	09	11	09	12
Weighted Percentage of COs Contribution to POs	66.6	73.3	80	60	73.3	60	80

0 – Not Correlation 1 – Low 2 – Moderate 3 - High

COURSE CONTENT

UNIT-I Introduction to Solar energy (L-5Hrs + T – 1Hr)

Introduction, Advantages and Disadvantages of Solar Panel, Utilization of Solar Power Supply System in the Indian Railways, Application of Solar Powered System for Signaling & Telecommunications, Advantages of Solar Powered System for Signaling.

UNIT-II Construction & Working of Photo Voltaic (L-5Hrs + T – 1Hr)

Photo Voltaic effect, Solar Cell: Construction & Working, Solar Photo Voltaic (SPV) Module, Solar Panel, Main Components of Solar Photo Voltaic System - Solar Array, Battery Bank, Solar Charge Controller, Field Junction Box (FJB), Solar Module Mounting Structure, Earthing kit, Cables, Operation, Types of Solar Panels.

UNIT-III Designing a Solar Photovoltaic System (L-5Hrs + T – 1Hr)

Definitions - Solar Cell, Solar Module, Solar Panel, Solar Array, Solar irradiation, Insolation, Peak Sun Hours, Conversion Efficiency, General & Technical requirements for Solar Photo Voltaic Module - General Requirements, Technical requirements, Primary phases of designing an SPV system, Planning, Collection of Information/data - Load/ Application, Climatic conditions, User compatibility, Load calculation - For DC Loads, For AC Loads, Sizing Solar Array, Deciding Battery capacity, Selection of Charge Controller - Salient feature of Charge controller, Module mounts, Structure, Wiring, Sample system design – detailed steps, Solar Panel Requirement for IPS System at PI Station in Non-RE Area.

UNIT-IV Installation of Solar Panel (L-5Hrs + T – 1Hr)

Introduction, Testing before installation, IV curve of a 35-Watt Solar Module, Installation guidelines - Mounting the Solar Modules, Sketch showing Panel Height, spacing between adjacent rows and angle of tilt, Electrical Interconnections – Cables, Connections to the Solar module, Interconnections between Charge controller and Solar Modules.

UNIT-V Maintenance & Troubleshooting (L-5Hrs + T – 1Hr)

Maintenance - Precautions and Preventive Steps, Troubleshooting - SPV Power Source, troubleshooting methods for Solar modules, Troubleshooting flowchart for SPV Panel.

Tutorial Section

Unit	Topic	Hours
I	Application of Solar Powered System	1
II	Types of Solar Panels	1
III	Primary phases of designing an SPV system	1
IV	Cables connections to the Solar module	1
V	Troubleshooting flowchart for SPV Panel	1

Text Books:

1. Material prepared by Department of Electronics.
2. "Handbook on Installation & Maintenance of Solar Panel" Indian Railways Centre for Advanced Maintenance Technology.

Reference Book:

1. Rabindra Kumar Satpathy, Venkateswarlu Pamuru "Solar PV Power: Design, Manufacturing and Applications from Sand to Systems", Academic Press Inc , 2020
2. Solanki C.S "Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers", Prentice Hall India Learning Private Limited, 2013.

Websites for reference:

1. https://www.energy.gov/eere/solar/solar-photovoltaic-system-design-basics
2. https://www.electricaltechnology.org/2020/07/design-and-installation-of-solar-pv-system.html

Open Elective: ELECTRONIC GADGETS AND HOME APPLIANCES

Preamble: The demand of electronic gadgets and home appliances is increasing day by day. It is constantly making our day-to-day life easy and smart. The aim of the course is to help the student to attain depth knowledge of electronic gadgets and household devices. This course will introduce the students with working principles, main features and care and Maintenance of such electronics appliances used in everyday life.

Category	Course Type	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
Part IV	Open Elective	U21EL6OE	Electronic Gadgets and Home Appliances	-	-	-	3

Conduct hours per semester: -
Conduct hours per week: -

Year	Semester	Internal Marks	External Marks	Total Marks
Third	VI	00	100	100

Course Outcomes (COs)

On successful completion of course, the leaner should be able to

Co No.	Course Outcome	Knowledge Level (RBT)
1	Identify the principles of home electronic gadgets like recording devices, Remote Control, Video Games, Musical Instruments and Security Systems, Digital Diaries, Digital Calculators and Camcorders, Microphones, TV Broadcasting Systems.	K1
2	Understand the fundamental concepts of household and office devices	K2
3	Interpret the main features of electronic appliances	K3
4	Analyze the care and maintenance of electronic home and office devices	K4
5	Evaluate the working principles of the household gadgets and electronics appliances	K5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO Mapping (Course Articulation Matrix)

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
1	1	2	3	2	3	2	3
2	2	3	3	3	1	3	2
3	3	2	2	1	1	2	2
4	2	0	2	3	2	1	2
5	3	2	2	1	0	2	2
Total Contribution of COs to POs	11	09	12	10	7	10	11
Weighted Percentage of COs Contribution to POs	73.3	60	80	66.6	46.7	66.6	73.3

0 – Not Correlation 1 – Low 2 – Moderate 3 - High

COURSE CONTENT

UNIT I Recording and Reproductions

Analog sound recording and reproduction – Digital sound recording and reproduction – Block diagram of disk recording and disk reproduction system - Optical recording on disk

UNIT II Remote Control, Video Games, Musical Instruments and Security Systems

Remote Control: Operating principle – Block diagram – features. **Video Games:** Operating principle – Block diagram – features. **Musical Instruments:** Operating principle – Block diagram – features. **Security Systems:** Operating principle – Block diagram

UNIT III Digital Diaries, Digital Calculators and Camcorders

Digital Diaries: Operating principle – Block diagram – features. **Digital Calculators:** structure of a calculator **–** Block diagram - Block diagram with register. **Camcorders:** Operating principle – Block diagram – features

UNIT IV Microphones

Microphone – Characteristics of microphones – Output level – Directivity – Microphone types: Moving coil – Ribbon – Capacitor

UNIT V TV Broadcasting Systems

Monochrome TV transmitter – Monochrome TV receiver – Color TV transmitter - Color TV receiver

Text Books

1. S.P.Bali "**Consumer Electronics"**, First edition, PEARSON, 2008
2. Dr.J.S Chode "**Consumer Electronics"**, First edition, Seventh reprint 2014, Technical Publication

Reference Books

1. Dr.B R Gupta and V. Singhal "**Consumer Electronics"**, 10th Revised Edition, S K Kataria & sons, 2013
2. Bali R & Bali S.P, "Audio video systems: principle practices & troubleshooting", Khanna Book Publishing Co. (P) Ltd., India 2010

Websites for Reference

1. https://www.slideshare.net/
2. https://www.scienceabc.com/
3. https://www.lecturenotes.in/
4. https://www.electronics-notes.com/