BANGALORE UNIVERSITY

CURRICULUM FOR B Sc DEGREE & B Sc HONS. (ELECTRONICS)

(According to NEP – 2020 Regulations)

SUBJECT: ELECTRONICS

(2022 – 23 Onwards)

BANGALORE UNIVERSITY
Department of Electronic Science
Jnana Bharathi, Bangalore – 560056

September, 2023

CONTENTS

PROCEEDINGS OF BOS MEETING

Meetings of BoS UG was convened at the Chairman's Chamber, Department of Electronic Science, Bangalore – 560060 to frame the syllabus for B.Sc. 5th and 6th semester Electronic Course under the New Education Policy (NEP)-2020. The committee convened *i.e.*, on 01.09.2023 and exhaustive discussion were made. Finally, it was decided to adopt the syllabus framed by the expert committee for 5th and 6th semesters of the B Sc Electronics Course as per the State Government of Karnataka, the core committee framed the course syllabus through Department of Higher Education Council (DHEC), Government of Karnataka with minor modifications.

The following members were present. (*The opinion and approval of the outstation members was received through e-mail*).

Sl No.	Name	Designation	Signature
1.	Mrs Gayathri Sudhir Professor & Vice Principal, Department of Electronics, Oxford college of Arts, Science and Commerce, HSR Layout, Bangalore	Member (UG)	Gayathri
2.	Dr Benny Sebastin Associate Professor, Department of Electronics, Christ University, Bangalore	Member (UG)	BSebastin
3.	Dr Subramanya Bhat M Associate Professor, Department of Electronics, Vijaya College,RV road, Bangalore	Member (UG)	
4.	Dr Manjesh Professor Department of Electronic Science, Bangalore University, Bengaluru – 56056	Chairman (UG)	1/9/23

The Board placed a record of the appreciation for the members of the previous BOS members for their contributions to the academics of the department. The Chairman extended warm welcome to the constituted members of the BOS and thanked for the acceptance of the invitation with short notice.

The main agenda of the meeting i.e., framing of syllabus for the B Sc 5th and 6th semester degree in Electronics under NEP was taken for discussion. After thorough discussions the following resolutions were made.

The following Resolutions were made:

1. The committee unanimously agreed to adopt the structure (*appendix - 1*) suggested by the Karnataka State Higher Education Council (KSHEC) under NEP program and also to consider the proposed curriculum for the 3rd and 4th semesters UG program in Electronics (*appendix -2*) with effect from 2022- 23

2. Minor changes in the curriculum were made related to the teaching hours for theory & practical classes, maximum marks for the papers and minimum marks for passing, credits to the respective papers, etc.

3. ***Eligibility criteria for Admission to the B Sc Electronics***: Students who have qualified PUC/ 10+2 /ITI or equivalent are eligible for opting Electronics in UG program.

4. Diploma in Electronics / Electrical / Medical Electronics / Computer Science / Telecommunications or equivalent are eligible for lateral entry to III semester.

5. The board discussed about the option for the candidates to choose the open elective paper. After elaborate discussions it was unanimously decided that open elective may be given to all students including the candidate's opted electronics as major subject.

6. The Scheme for awarding internal assessment for the students was discussed and approved.

7. It was resolved that number of students for practical shall be 10 (Ten) per batch per teacher.

Finally, the Chairman extended vote of thanks to all BOS members for their presence.

Preamble

This model curriculum content for B Sc (Honours) Electronics as per NEP – 2020, is intended to enable the graduates to respond to the current needs of the industry and equip them with skills relevant for national and global standards. The framework encourages innovation in teaching-learning process and appropriate assessment of student learning levels.

Introduction

B Sc (Honours) Electronics is a program which needs to develop a specialized skill set among the graduates to cater to the need of industries.

The curriculum is designed to help the learners to analyze, appreciate, understand and critically engage with learning of the subject and also to provide better learning experience to the graduates. Apart from imparting disciplinary knowledge, the curriculum is aimed to equip the graduates with competencies like problem solving and analytical reasoning which provide them high professional competence.

The Department/Institute/University is expected to encourage its faculty concerned to make suitable pedagogical innovations, in addition to teaching/learning processes suggested in the model curriculum, so that the Course Program learning outcomes can be achieved.

Significance

In recent years, Electronics has made unprecedented growth in terms of new technologies, new ideas and principles. The research organizations and industries that work in this frontier area are in need of highly skilled and scientifically oriented manpower. This manpower can be available only with flexible, adaptive and progressive training programs and a cohesive interaction among the institutions, universities, and industries. The key areas of study within subject area of Electronics comprise of Semiconductor Devices, Power Electronics and Motor rives, Analog and Digital Circuit design, Microprocessors & Microcontroller Systems, Computer Coding, Programming in high level languages etc. and also modern applied fields such as Embedded Systems, Data Communication, Robotics, Control Systems, Nano Electronics and Nano Electronic Devices etc.

Eligibility criteria

Students who have qualified PUC 10+2 ITI or equivalent are eligible for opting Electronics in UG program.

Program Objectives

The overall Objectives of the B.Sc. (Degree) / B.Sc. (Honours) Electronics program are to:

- Provide students with learning experiences that develop broad knowledge and understanding of key concepts of electronics and equip students with advanced scientific , technological capabilities for analyzing and tackling the issues and problems in the field of electronics.
- Develop ability in students to apply knowledge and skills they have acquired to solve specific theoretical and applied problems in electronics.
- Develop abilities in students to design and develop innovative solutions for benefits of society.

- Provide students with skills that enable them to get employment in industries or pursue higher studies or research assignments or turn as entrepreneurs.

Program Outcome

- Aptitude to apply Logic thinking and Basic Science knowledge for problem solving in various fields of electronics both in industries and research.
- To acquire experimental skills, analyzing the results and interpret data.
- Ability to design develop manage operation and maintenance of sophisticated electronic gadgets systems processes that conforms to a given specification within ethical and economic constraints.
- Capacity to identify and implementation of the formulate to solve the electronic related issues and analyze the problems in various sub disciplines of electronics.
- Capability to use the Modern Tools Techniques

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APPENDIX- 2: Syllabus

5th Semester B.Sc. Course Curriculum Semester- V

DSCEL501: Paper-5: Communication II

(Credits: Theory – 04, Practical – 02) **Total Teaching: 60 Hrs**

Course Objectives: After the successful completion of the course, the student will be able to:

- To understand the various microwave devices and their working
- To understand principle and working of different digital modulation techniques.
- To understand the principle and working of Cellular Communication, different wireless techniquesand mobile handset.
- To understand various OSI layers, Wi-Fi and IEEE standards.

Course Outcomes:

CO-1:Know the various microwave devices, their working and applications.
CO-2: Familiar with ASK, FSK, PSK, BPSK, QPSK digital modulation techniques..
CO-3: Understand the basic concept of cell phone handset, working principle of cellular communication and wireless technologies.
CO-4:. Understand different Computer Networks, OSI layers, Ethernet and IEEE 802.11a/b g n standards.
CO-5: Understand the Working of GUNN diode & READ diode

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

After the successful completion of the course, the student will be able to:

		1	2	3	4	5	6
CO-1:	Know the various microwave devices, their working and applications.						
CO-2:	Familiar with ASK, FSK, PSK, BPSK, QPSK digital modulation techniques.						
CO-3:	Understand the basic concept of cell phone handset, working principle of cellular communication and wireless technologies.						
CO-4:	Understand different Computer Networks, OSI layers, Ethernet and IEEE 802.11a/b/g/n standards.						
CO-5:	Understand the Working of GUNN diode & READ diode						

Pedagogy: ICT lecture method, group discussion, seminar etc.

Formative Assessment Assessment Occasion	Weightage in Marks
Attendance Specified Activity in the syllabus	05*
Internal Tests (Minimum of Two)	25
Assignments Seminar Case Study Project work Reports on - visits to industries exhibitions science centre"s active participation in Electronics competitions, etc	10
Total	40

* Criteria for awarding the marks: 75-85% - 2 marks; 85-95% - 4 marks and > 95% - 5 marks

UNIT1 **15 Hrs**

Microwave Devices: RF Microwaves. EM spectrum, Wavelength and frequency, rectangular waveguides, circular waveguides, microwave cavities, microwave hybrid circuits, directional couplers, circulators and isolators, GUNN diode, READ diode, IMPATT diode, BARITT diode, PIN diodes, Schottky barrier diodes, Multi cavity Klystron, Magnetron, block diagram of Microwavecommunication and working, Applications.

UNIT 2 **15 Hrs**

Digital Communication: Block diagram of digital transmission and reception, Bit Rate and Baud, Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Binary Phase Shift Keying (BPSK) and Quadrature Phase Shift Keying (QPSK), 8PSK, 16PSK, 64PSK - definition and waveforms for each.

Quadrature amplitude modulation (QAM): 16 QAM and 64 QAM - definition and waveforms for each. Advantage and disadvantages of digital transmission, characteristics of data transmission circuits – Shannon limit for information capacity, bandwidth requirements, data transmission speed, noise, cross talk, echo suppressors, distortion and equalizer, MODEM–modes and classification

Unit 3 **15 Hrs**

Cellular Communication: Concept of cellular mobile communication cell and cell splitting, frequency bands used in cellular communication, Absolute RF channel numbers (ARFCN), frequency reuse, roaming and hand off, authentication of the SIM card of the subscribers, IMEI number, concept of data encryption, architecture (block diagram) of cellular mobile communication network, Multiplexing, FDMA, WCDMA, TDMA, OFDMA, GSM-Qualitative analysis.

Bluetooth, Zigbee, Wi-Fi, MIMO, LTE, 5G technology and CV2X- qualitative analysis. Simplifiedblock diagram of cellular phone handset, Wireless channel characteristics.

Unit 4 **15 hrs**

Computer Networks: Introduction to Networks, Categories of Networks, Layered tasks, OSI Model, Layers in OSI model, TCP IP Suite, Addressing, Switching, Telephone and cable networksfor data transmission, Telephone networks, Dial up modem, DSL, Cable TV for data transmission, Wired LAN, Ethernet, IEEE standards, Standard Ethernet, Changes in the standards, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11a b g n, Connecting LANs.

Suggested Learning Resources

ReferenceBooks	
1	D Roddy and J. Collen,"Electronicscommunications",4th edition, PHI,2008
2	B. P. Lathi and ZhiDing, "Modern Digital and Analog Communication Systems", Oxford University Press,4thEdition, 2010
3	Bernard S k la 'Digital Communications: Fundamentals and Applications" Pearson Education, 2nd edition, 2009.
4	David T se,Pramod Viswanath 'Fundamentals of Wireless Communication',Cambridge University Press,1stedition,2005
5	Wayne Tomasi "Advanced Electronic Communication Systems", -6th edition, Low priced edition-Pearson Education
6	Wayne Tomasi "Electronic Communication Systems, Fundamentals through Advanced", 5th edition.
7	Kennedy & Davis, "Electronic Communication Systems", IVth edition-TATAMcGraw Hill.

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5th Semester B.Sc. Course

Curriculum DSCELP501:

Paper 5: Communication II Lab

(Credits: Theory – 04, Practical – 02) **Total Teaching: 60 Hrs**

Part - A

1. Study of ASK generation and Detection
2. Study of FSK generation and Detection
3. Study of PSK generation and Detection
4. Second order active filter
5. QPSK modulator and demodulator

Demonstration Experiments

6. Determination of V-I Characteristics curve of a Gunn Diode
7. Study of notch filter.
8. Class C tuned amplifier
9. Study of Switched mode regulator using PWM.

Part- B

Simulation Experiments.

1. Simulate NRZ, RZ, half-sinusoid and raised cosine pulses and generate eye diagram for polar signaling.
2. Pulse code modulation and demodulation system.
3. Computations of the Probability of bit error for coherent binary ASK, FSK and PSK for an AWGN Channel and compare them with their Performance curves.
4. DPSK Transmitter and receiver
5. QPSK Transmitter and Receiver.

Scheme of Internal Assessment Marks: PRACTICALS

Sl. No	Particulars	IA Marks
1	PracticalTest	10
2	Report on datasheet of electronic devices / Seminar on electronics experiments, etc.	10
3	Active participation in practical classes	05
	TOTAL Practical IA Mark	**25**

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DSCEL502: Paper 6: Embedded Controllers

(Credits: Theory – 04, Practical – 02) **Total Teaching: 60 Hrs**

Course Objectives:

- To know the importance of microcontrollers and its applications
- Understand the basics of Embedded Systems hardware and software concepts.
- Acquire knowledge about 8051and PIC Microcontrollers and its peripherals

Course Outcomes:

CO-1:Identify and understand function of different blocks of 8051 microcontrollers.
CO-2:Develop program for I O port operations, Timers, Serial port and Interruptsusing C.
CO-3:Gain the knowledge to interface LCD, Keyboard, ADC using 8051 Microcontroller.
CO-4:Gain the knowledge to interface LCD, Keyboard, ADC using 8051 PIC
CO-5:Design and develop small scale embedded systems.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

		1	2	3	4	5	6
CO-1	Identify and understand function of different blocks of 8051 microcontrollers.						
CO-2	Develop program for I O port operations, Timers, Serial port and Interruptsusing C.						
CO-3	Gain the knowledge to interface LCD, Keyboard, ADC using 8051 Microcontroller.						
CO-4	Gain the knowledge to interface LCD, Keyboard, ADC using 8051 PIC						
CO-5	Design and develop small scale embedded systems.						

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Pedagogy: ICT lecture method, group discussion, seminar etc.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Attendance Specified Activity in the syllabus	05*
Internal Tests (Minimum of Two)	25
Assignments Seminar Case Study Project work Reports on - visits to industries/exhibitions/science centre"s , active participation in Electronics competitions, etc.	10
Total	40

* Criteria for awarding the marks: 75-85% - 2 marks; 85-95% - 4 marks and > 95% - 5 marks

Scheme of Internal Assessment Marks: THEORY

Sl. No	Particulàrs	IA Marks
1	Attendance Specified Activity in the syllabus	05*
2	Internal Tests (Minimum of Two)	5
3	Assignments Seminar Case Study / Project work / Reports on - visits to industries exhibitions science centre"s / active participation in Electronics competitions, etc.	10
	TOTAL TheoryIA Mark	40

*** Criteria for awarding the marks: 75-85% - 2 marks; 85-95% - 4 marks and > 95% - 5 marks**

Unit 1

10 Hrs

Introduction to Microprocessors and Microcontrollers: Microprocessor Architecture-Harvard and Van-Neumann Architecture, CISC and RISC processors and their architectures. Difference between microprocessor and microcontroller.

Introduction to Embedded Systems, Examples of Embedded Systems, Design Parameters of Embedded Systems, Embedded Software Development Tools: Integrated Development Environment (IDE). Editor, Assemblers, Compilers, linker, loader, Instruction Set Simulator (ISS) Debugging Tools and Techniques, Emulators. 8051 Microcontroller: Architecture, Registers, Pin diagram, I O ports functions, Internal Memory organization, External Memory (ROM & RAM) interfacing

Unit 2

14 Hrs

Addressing Modes, Instruction set, Simple Assembly language program examples to use the instructions of 8051. Stack and Subroutine instructions. Assembly language Illustrative programs. Timer counter, serial communication, interrupts and interfacingof 8051.

Unit 3

16 Hrs

PIC18 Microcontrollers: Overview of the PIC microcontroller family, Architecture and features of 18F458, Memory organization, Data memory organization, EEPROM, flash memory, Special Function Registers, Program Counter, Configuration registers, Stack memory, Interrupts, I O ports, Timers, USART, Capture Compare PWM (CCP) Modules, MSSP Serial Port, CAN module, ADC, Special features of the CPU, Oscillator sources, Clock source switching, Instruction set, Watchdog Timer.

Unit 4 20 Hrs

Hardware interfacing and Microcontroller Programming in C: Data types and time delays. Data Serialization in C. Introduction to Communication Protocols – RS 232, I2C, USB, USART, SPI, CAN, and IrDA.

Program ROM allocation, Data RAM allocation, I O Programming, Timer programming, Automatic Stack operations, Programmer access to the Stack, serial port programming, interrupt programming, generation of PWM signal PWM MotorControl with CCP.

Interfacing to 8051 and PIC: Switch, LED, seven segment LED, Keyboard, LCD, External ADC, DAC interfacing, Stepper motor, DC motor interfacing, Real time clock (RTC) and serial ADC.

Erasing and Writing Flash & EEPROM Memories for Data Storage. Sensor Interfacing and Signal Conditioning Standard.

Reference Books

1. Muhammad Tahir and Kashif Javed, "ARM Microprocessor Systems: Cortex- M Architecture, Programming, and Interfacing." 1st Edition, CRC Press, 2017.

Kenneth J. Ayala, "The 8051 Microcontroller", 3rd Edition, Thomson/ Cengage Learning,1997

2. Muhammad Ali Mazidi and Janice Gillespie and Rollin D. "The 8051 Microcontroller and Embedded Systems using assembly and C."1st Edition,Pearson, 2006.
3. Tim Wilmshurst, "Designing Embedded Systems with PIC Microcontrollers:Principles and applications", First Edition, Elsevier, 2007.
4. Muhammad Ali Mazidi and Rolin D. Mckinlay, "PIC Microcontroller and Embedded Systems using assembly and C for PIC18," 1stEdition, Pearson,2008.
5. John Pitman, "Design with PIC Microcontrollers," 1st Edition, Prentice Hall,1997.

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(Credits: Theory – 04, Practical – 02 Total Teaching: 60 Hrs

DSCELP502: Paper -6: Embedded Controllers Lab

Part -A: Assembly language programming with 8051 Microcontroller

(Experiments to be conducted using using 8051-kit and simulator)

1. Addition and Subtraction of 8-bit and 16 bit numbers considering carry.
2. To verify the given numbers is prime or not.
3. Finding Largest and Smallest among n numbers.
4. To generate square of a number (1 to 10) using look-up table.
5. To find 2's complement of a 16-bit number

Part – B: Interfacing with 8051 and PIC18F458 Microcontroller

(Programs to be written using C)

1. Interfacing of switch s and LED s. a) To read switch status if switch is on, turn on LED orif switch is off, turn off LED. b) To blink the LED with different delay.
2. To interface seven segment LED display and Program to implement count down/updecimal digit 9-0
3. LCD (2X16) interfacing.
4. Interfacing of stepper motor and Rotating stepper motor by N stepsclockwise, anticlockwise with speed control
5. Generate square, saw tooth, triangular and staircase waveform using DAC interface.

Demonstration Experiments

6. Display of 4- digit decimal number using the multiplexed 7-segment display interface.
7. Analog to digital conversion using internal ADC and display the result on LCD (usingInternal ADC in PIC18F458).
8. Interfacing of serial ADC (MCP320x).
9. Speed control of DC motor using PWM (pulse delay to be implemented using timers).
10. To stop start toggling of LED, when there is an external interrupt.
11. Interfacing of matrix keyboard (4X4).
12. Serial communication between microcontroller and PC.
13. Interfacing of Real Time Clock (DS1307).
14. Interfacing of I²C Based EEPROM,RAM Flash.

Scheme of Internal Assessment Marks: PRACTICALS

Sl. No	Particulars	IA Marks
1	PracticalTest	10
2	Report on datasheet of electronic devices Seminar on electronics experiments, etc.	10
3	Active participation in practical classes	05
	TOTAL Practical IA Mark	**25**

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6th Semester Syllabus

DSCEL601: Paper – 7: IOT and Instrumentation

(Credits: Theory – 04, Practical – 02) **Total Teaching: 60 Hrs**

Course Objectives:

- Acquire the knowledge of various types of measurement systems and to know the Importance of measuring instruments.
- To know different types of errors due to the measurement systems
- Understand the basic concepts and principles of the Internet of Things.
- Gain knowledge of different IoT technologies and protocols.
- Acquire practical skills in designing and implementing IoT applications.
- Develop an understanding of IoT security and privacy considerations

Course Outcomes:

CO-1 Able to calibrate the instruments to minimize measurement errors.
CO-2 Understand the basic concepts and principles of the Internet of Things.
CO-3 Gain knowledge of different IoT technologies and protocols.
CO-4 Acquire practical skills in designing and implementing IoT applications.
CO-5 Gain knowledge of Wi-Fi, Bluetooth, Zigbee, LoRaWAN.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

		1	2	3	4	5	6
CO-1	Able to calibrate the instruments to minimize measurement errors						
CO-2	Understand the basic concepts and principles of the Internet of Things.						
CO-3	Gain knowledge of different IoT technologies and protocols.						
CO-4	Acquire practical skills in designing and implementing IoT applications.						
CO-5	Gain knowledge of Wi-Fi, Bluetooth, Zigbee, LoRaWAN.						

Pedagogy: ICT lecture method, group discussion, seminar etc.

Formative Assessment	
Assessment Occasion	Weightage in Marks
Attendance · Specified Activity in the syllabus	05*
Internal Tests (Minimum of Two)	25
Assignments Seminar Case Study Project work Reports on - visits to industries exhibitions science centre"s active participation in Electronics competitions, etc.	10
Total	40

* Criteria for awarding the marks: 75-85% - 2 marks; 85-95% - 4 marks and > 95% - 5 marks

Scheme of Internal Assessment Marks: THEORY

Sl. No	Particulars	IA Marks
1	Attendance Specified Activity in the syllabus	05*
2	Internal Tests (Minimum of Two)	5
3	Assignments Seminar Case Study · Project work Reports on - visits to industries exhibitions science centre"s / active participation in Electronics competitions, etc.	10
	TOTAL TheoryIA Mark	40

*** Criteria for awarding the marks: 75-85% - 2 marks; 85-95% - 4 marks and > 95% - 5 marks**

Unit — I: **15 Hrs**

Definition and evolution of the Internet of Things. IoT architecture and components. IoT communication protocols: MQTT, CoAP, HTTP. IoT application domains and use cases. Overview of IoT devices: microcontrollers, sensors, actuators. Types and characteristics of sensors used in IoT applications. Interfacing sensors with microcontrollers. Data acquisition and sensor fusion techniques.

Unit— II: **15 Hrs**

Wireless communication technologies for IoT: Wi-Fi, Bluetooth, Zigbee, LoRaWAN, etc. IoT network topologies: star, mesh, and hybrid networks. IoT data management and storage. IoT protocols for device-to-device and device-to-cloud communication. IoT application development platforms and frameworks. Design and implementation of IoT applications. IoT security challenges and solutions. Privacy and ethical considerations in IoT.

Unit— III: **15 Hrs**

Measurement System: Introduction to general measurement system, significance of measurements, methods of measurements, instruments and measurement systems, Functions of instruments and measurement systems, Applications of measurement systems.

Instruments Performance Characteristics: Definitions and problems as applicable. Static Characteristics-Static error, static correction, scale range and scale span, reproducibility and drift, repeatability, Signal to noise ratio, sources of noise, accuracy, precision, linearity, hysteresis, threshold, dead time.

Dynamic Characteristics-Fidelity, frequency response, dynamic error, etc..

Measurement Errors: Introduction, gross errors and systematic errors, absolute and relative errors, basic concepts of accuracy, precision, resolution.

Transducers: Classification of transducers, basic requirement of transducers, principle of operation and construction details of resistive, inductive, capacitive, temperature, ultrasonic, photoelectric, pressure, fiber optic and MEMS based transducers. Measurement techniques for motion, seismic, flow, level, humidity, pH, viscosity. Signal conditioning techniques using op-amp instrumentation amplifier, carrier, chopper, isolation amplifier

15 Hrs

Unit 4:

Bio potential electrodes: Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode– skin interface, half-cell potential, impedance, polarization effects of electrode – non polarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits.

Electrode configurations: Bio-signals characteristics – frequency and amplitude ranges. ECG – Einthoven's triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG, ERG and EOG – unipolar and bipolar mode.

Bio amplifier: Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier – right leg driven ECG amplifier. Band pass filtering, isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier. Chopper amplifier.

Reference Books

1. John G. Webster. "Medical Instrumentation Application and Design", John Wiley and sons. New York. 2004
2. Joseph J. Carr and John M. Brown. "Introduction to Biomedical Equipment Technology". Pearson Education. 2004
3. Leslie Cromwell. "Biomedical Instrumentation and measurement", Prentice hall of India.
4. New Delhi. 2007.
5. Khandpur R.S. "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi. 2003.
6. Standard Handbook of Biomedical Engineering & Design – Myer Kutz, McGra-Hill Publisher 2003

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DSCELP601: Paper - 7 Lab: IoT experiments

(Credits: Theory – 04, Practical – 02 Total Teaching: 60 Hrs

PART-A

(IOT-Practicals)

1. Starting Raspbian OS, Familiarization with Raspberry Pi components and Interface, Connecting to Ethernet, Monitor, USB.
2. Displaying different LED patterns with Raspberry Pi.
3. Displaying Time over 4-Digit 7-Segment display using Raspberry Pi.
4. Raspberry Pi based Oscilloscope.
5. Controlling Raspberry Pi with WhatsApp.

Demonstration experiments

6. Setting up wireless Access point using Raspberry Pi.
7. Fingerprint Sensor interfacing with Raspberry Pi.
8. Raspberry Pi GPS module interfacing.
9. IoT based Web Controlled Home Automation using Raspberry Pi.
10. Visitor Monitoring with Raspberry Pi and Pi Camera.

PART-B

1. Modelling of control systems. Block diagram reduction: Given the transfer function of Individual blocks, determine the transfer function of the system.
2. Simulation of Step response & impulse response:
3. Study of 1st and 2nd order system's response with variations in ξ and ω_n.
4. Study of effect of addition of simple poles and zeros on the stability and response of a system.
5. Stability analysis of LTI systems using Root locus and determination of different time domain specifications from the plots.

Scheme of Internal Assessment Marks: PRACTICALS

Sl. No	Particulars	IA Marks
1	PracticalTest	10
2	Report on datasheet of electronic devices Seminar on electronics experiments, etc.	10
3	Active participation in practical classes	05
	TOTAL Practical IA Mark	25

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DSCEL602: PAPER 8: Control systems and Robotics

(Credits: Theory – 04, Practical – 02 **Total Teaching: 60 Hrs**

Course Objectives:

- Understand the basic concepts and principles of the Control Systems
- Gain knowledge of different Control Systems
- Acquire practical skills in designing and implementing Control Systems
- To acquire the working principle of robots
- Understand the working principle of sensors
- To know the working principles of actuators

Course Outcomes:

CO-1:Understand the basic concepts and principles of the Control Systems and Robotics.
CO-2:Gain knowledge of different Control Systems and Robotics technologies and protocols.
CO-3:Acquire practical skills in designing and implementing Control Systems and Robotics applications.
CO-4:Develop an understanding of Control Systems and Robotics security and privacy considerations
CO-5:Design an embedded system for the working of a robot.
CO-6:Select the robot type depending on the application requirements
CO-7:Acquire the basic robot programming skills

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

		1	2	3	4	5	6
CO-1:	Understand the basic concepts and principles of the Control Systems and Robotics.						
CO-2:	Gain knowledge of different Control Systems and Robotics technologies and protocols.						
CO-3:	Acquire practical skills in designing and implementing Control Systems and Robotics applications.						
CO-4:	Develop an understanding of Control Systems and Robotics security and privacy considerations.						
CO-5:	Design an embedded system for the working of a robot.						
CO-6:	Select the robot type depending on						

	the application requirements.			
CO-7:	Acquire the basic robot programming skills			

Pedagogy: ICT lecture method, group discussion, seminar etc.

Formative Assessment	
Assessment Occasion	**Weightage in Marks**
Attendance Specified Activity in the syllabus	05*
Internal Tests (Minimum of Two)	25
Assignments Seminar Case Study Project work Reports on - visits to industries/exhibitions/science centre"s active participation in Electronics competitions, etc.	10
Total	40

* Criteria for awarding the marks: 75-85% - 2 marks; 85-95% - 4 marks and > 95% - 5 marks

Scheme of Internal Assessment Marks: THEORY

Sl. No	Particulars	IA Marks
1	Attendance Specified Activity in the syllabus	05*
2	Internal Tests (Minimum of Two)	5
3	Assignments /Seminar Case Study / Project work / Reports on - visits to industries exhibitions science centre"s / active participation in Electronics competitions, etc.	10
	TOTAL Theory IA Mark	40

*** Criteria for awarding the marks: 75-85% - 2 marks; 85-95% - 4 marks and > 95% - 5 marks**

Unit 1 **15 Hrs**

Introduction to systems. Control systems. need for control. Classification of Systems. Open loop and Closed Loop Control System with examples BIBO stability of systems Mathematical models of physical systems: Introduction. differential equation of physical systems. mechanical systems. electrical systems, Analogous systems. Force (Torque)-Voltage and Force (Torque)- Current analogy Review of Laplace Transforms Transfer functions of armature controlled and field controlled servomotors. Block diagram algebra. block diagram reduction. Signal flow graphs. Mason's gain formula. Time response analysis: Introduction. standard test signals. Transfer function of systems. time response of first order system subjected to unit step input. Second Order Systems. Unit Step Response of Underdamped Second Order Systems. Concepts of Rise Time. Peak Time. Maximum Peak Overshoot and Settling Time. Steady state error and static error constants.

Unit 2 **15 Hrs**

Type (Type-0. Type-I. Type-II) of feedback control systems. Concept of stability: The concept of stability. necessary conditions for absolute stability, conditional and relative stability. Stability analysis in the s-domain.

Determining stability of systems using different techniques: Routh-Hurwitz stability criterion, relative stability analysis. Frequency Response. magnitude and phase plots, polar plots, Relative Stability – Gain and Phase Margins Nyquist Stability Criterion, Nyquist Plots, Bode Plots (understanding the plots and determining PM and GM and hence stability of systems

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from Nyquist Bode plots). Controllers P, PI, PD and PID controllers. Transfer function and comparison Lead, Lag and Lag-Lead Compensators, comparison (introductory concepts only)

Unit 3 **15 Hrs**

Definitions of Robots, Robotics, Motivation, A Brief History of Robotics, A Robot System, Interdisciplinary Areas in Robots, Classification of Robots, Introduction to embedded system, Understanding Embedded System, Sensors, Classification of sensors(contact & non-contact), characteristics of sensors, Touch sensor, Position sensor, optical sensor, IR, PIR, Ultrasonic, temperature, displacement sensor.

Unit 4 **15 Hrs**

Getting Started with Programming platform of Robots: Installation of IDE, Pin configuration and architecture of Microcontroller (Atmel series Arduino), Device and platform features, Concept of digital and analog ports, Familiarizing with Interfacing Board, Introduction to Embedded C platform, Review of Basic Concepts, Arduino data types, Variables and constants, Operators.

Control Statements, Arrays Functions, I o Functions, Pins Configured as INPUT, Pins Configured as OUTPUT, Incorporating time delay () function, delay Microseconds () function, millis () function , micros() function.

Reference Books Robotics

1. Fundamentals of Robotics by D K Pratihar
2. Robotics Simplified: An Illustrative Guide to Learn Fundamentals of Robotics, by Dr. Jisu Elsa Jacob, Manjunath N
3. Introduction to Robotics Fourth Edition by John Craig
4. Arduino Robotics by John-David Warren (Author), Josh Adamsduino
5. Programming in 24 Hours by Richard Blum
6. Getting Started with Arduino: The Open Source Electronics Prototyping Platform Book by Massimo Banzi and Michael Shiloh
7. Robotics for Engineers –Yoram Koren, McGraw Hill International, 1st edition, 1985. Robotic Engineering - An Integrated approach, Klafter, Chmielewski and Negin, PHI, 1st edition, 2009
8. An Introduction to Automated Process Planning Systems- Tiess Chiu Chang & Richard A.Wysk

Reference Books Control systems

1.Control system engineering: A.J Nagrath and M. Gopal, Wiley Eastern, 2nd Edition, 1982
2.Katsuhiko Ogata, Modern Control Engineering, Prentice Hall.
3.Benjamin C. Kuo, Automatic Control Systems, Prentice Hall.

BANGALORE UNIVERSITY
UNDER GRADUATE DEPARTMENT OF ELECTRONIC SCIENCE

DSCELP602: Paper - 8 Lab: Project Lab

(Credits: Theory – 04, Practical – 02) **Total Teaching: 60 Hrs**

- Students in a group, not exceeding THREE, should design, fabricate and assemble ONE Electronic project in their respective colleges. The department faculty is required to guide the project work.
- Each student should prepare a report and submit the report at the time of the practical examination duly certified by the concerned faculty guide & HOD.
- Department faculty shall ensure that the entire project work is carried out in their respective colleges by utilizing the practical classes assigned to practical VIII. A seminar on the project work is compulsory.

	Program Outcomes (POs)
PO-1	Ability to apply knowledge of science in solving electronics related problems
PO-2	Ability to design and conduct electronics experiments
PO-3	Ability to design and manage electronic systems.
PO-4	Ability to identify, formulate, solve and analyze the problems in various disciplines of electronics.
PO-5	Ability to identify, formulate, solve and analyze the problems in various disciplines of electronics
PO-6	Ability to communicate effectively in term of oral
PO-7	Recognize the need for, and be able to engage in lifelong learning.
PO-8	Ability to use scientific engineering software tools for professional practices
PO-9	Ability to use techniques, skills and modern technological.
PO-10	Ability to analyze and interpret data
PO-11	Ability to processes the conforms to a given specification within ethical and economic constraints
PO-12	Ability to written the communication skills