# ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

## Guwahati

## Course Structure and Syllabus

### APPLIED ELECTRONICS AND INSTRUMENTATION (AEI)

### Semester V/AEI/ B.TECH

| Sl.No. | Sub Code | Subject | Hrs/week | | | Credits C |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| **Theory** | | | | | | |
| 1 | EE131501 | Control System-I | 3 | 2 | 0 | 4 |
| 2 | AI131502 | Communication Theory | 3 | 2 | 0 | 4 |
| 3 | EE131503 | Power Electronics | 3 | 2 | 0 | 4 |
| 4 | EC131504 | Microprocessor and Applications | 3 | 2 | 0 | 4 |
| 5 | EC131505 | Digital Signal Processing | 3 | 0 | 0 | 3 |
| 6 | HS131506 | Principles of Management | 2 | 0 | 0 | 2 |
| **Practical** | | | | | | |
| 7 | EE131511 | Control System-I Lab | 0 | 0 | 2 | 1 |
| 8 | AI131512 | Communication Theory Lab | 0 | 0 | 2 | 1 |
| 9 | EE131513 | Power Electronics Lab | 0 | 0 | 2 | 1 |
| 10 | EC131514 | Microprocessor and Applications Lab | 0 | 0 | 2 | 1 |
| Total | | | 17 | 8 | 8 | **25** |
| Total Contact Hours : 33 | | | | | | |
| Total Credit : **25** | | | | | | |

**Course Title : CONTROL SYSTEM-I**
**Course Code: EE131501**
**L-T-P-C: 3-2-0-4**

| | |
|---|---|
| Class Hours/week | 4 |
| Expected weeks | 12 |
| Total hrs. of classes | 36+12 = 48 |

| MODULE | TOPIC | COURSE CONTENT | HOURS |
|---|---|---|---|
| 1 | **FUNDAMENTALS OF CONTROL SYSTEM** | Concepts of Open loop and closed loop systems. Examples of modern control systems, Definition of linear, non-linear, time-invariant and time variant, continuous and discrete control system. | 6 |
| 2 | **PHYSICAL SYSTEM MODELLING** | Formulation of differential equations for dynamic systems. Mechanical and Electrical systems. Transfer functions of a linear system. Block diagrams and reduction techniques, Signal flow graphs. Mason's formula. Standard test signals - step, ramp, parabolic and impulse. Impulse response. | 9 |
| 3 | **INTRODUCTION TO CONTROL SYSTEM COMPONENTS** | Error detectors, servo motors, techno-generators and servo amplifiers. Determination of transfer functions. | 5 |
| 4 | **TIME DOMAIN ANALYSIS** | Poles, Zeros and characteristic equations, Relation between S-plane root locations and transient response. Performance specifications in time domain such as overshot, rise time, settling time and steady state error. Transient response of second order systems. Derivative and Integral Control and their effect on the performance of the $2^{nd}$ order system. System types and error constants. Generalized error co-efficient. Transient response of higher order systems (out line only). Roth's stability criterion, scopes and limitations of Routh's criterion. | 10 |
| 5 | **THE ROOT LOCUS TECHNIQUE** | Introduction, Rule for construction. System analysis and design (outline only) using root locus. | 8 |
| 6 | **FREQUENCY DOMAIN ANALYSIS** | Logarithmic plots, polar plots, log-magnitude Vs phase plots. Nyquist stability criterion, Stability analysis. Relative stability. Close loop frequency response. Experimental determination of transfer functions. M and N circle. | 10 |
| | | **TOTAL** | **48** |

**TEXTBOOKS / REFERENCES:**


1. I.J. Nagrath & M. Gopal, "Control System Engineering", New Age International (P) Ltd.
2. Hasan-Saeed, "Automatic Control Systems", Katsons
3. Ramesh Babu and Anandanatarajan: "Control System Engineering" (Scitech)
4. Modern Control System – Hassan Sayed
5. Modern Control Engineering – Ogata
6. Control System Engineering - Nagrath and Gopal
7. Control System Components – Gibson and Teylor

**Course Title : COMMUNICATION THEORY**
**Course Code: AI131502**
**L-T-P-C: 3-2-0-4**

| | |
|---|---|
| Class Hours/week | 4 |
| Expected weeks | 12 |
| Total hrs. of classes | 36+12 = 48 |

| MODULE | TOPIC | COURSE CONTENT | HOURS |
|---|---|---|---|
| 1 | **INTRODUCTION TO COMMUNICATION** | Basic definition of information, messages & signals, classification of signals, the discrete and continuous spectrum, power spectrum energy density spectrum, Communication Process, Example of communication. | 6 |
| 2 | **AMPLITUDE MODULATION** | Principles of AM, DSB and SSB, AM modulation and demodulation circuits, AM Transmitters and receivers, Quadrature-Carrier Multiplexing, Single-Sideband and Vestigial-Sideband Methods of modulation, VSB Transmission of Analog and Digital Television. | 8 |
| 3 | **ANGLE MODULATION** | Introduction, Basic Definitions, FM and PM, Frequency modulation and demodulation methods, Phase-Locked Loop, Nonlinear Effects in FM Systems, The Super-heterodyne Receiver, pre-emphasis and de-emphasis filtering, Analog and Digital FM Cellular Telephones, Comparison of AM, FM and PM techniques. | 8 |
| 4 | **ANALOG PULSE MODULATION** | Sampling process, PAM and other forms of pulse modulation. Quantization process. Pulse code modulation, noise consideration in PCM. Frequency Division Multiplexing (FDM), Time Division Multiplexing (TDM). Delta modulation. Differential-PCM, adaptive-differential PCM. Matched filter. Intersymbol interference. Nyquist criterion for distortionless base band binary transmission: Nyquist rate. | 7 |
| 5 | **NOISE** | Atmospheric, thermal, shot and partition noise, noise figure and experimental determination of noise figure, shot noise in temperature limited diode and space charge limited diodes, Pulse response and digital noise. | 6 |

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| 6 | **DIGITAL MODULATION AND TRANSMISSION** | Amplitude shift keying, coherent phase shift keying, hybrid amplitude/phase modulation schemes, Coherent frequency shift keying, non-coherent BFSK, differential-PSK, quadrature PSK, minimum PSK, Comparison of digital modulation techniques- Generation and detection. | 8 |
| 7 | **BASIC INFORMATION THEORY** | Units of information, entropy, uncertainty and information rate of communication, redundancy, relation between system capacity and information content of messages, Channel capacity - Shannon`s Theorem, Lossless Data Compression. | 5 |
| | | **TOTAL** | **48** |

**TEXTBOOKS / REFERENCES:**


1. Communication System. Simon Haykin. John Wiley and Sons.
2. Principles of Communication Systems. Taub and Schilling. McGraw-Hill.
3. Communication System Engineering. Proakis and Salehi. PHI.
4. Digital Communication. Bernard Sklar. Pearson Education.
5. Modern Digital and Analog Communication Systems- B.P. Lathi & Zhi Ding International 4th Ed. Oxford University Press.
6. Modern Digital and Analog Communication Systems- Sharma Sanjay.
7. Signals and Systems-Oppenheim, Willsky and Young, PHI.
8. Signals and Systems- Sharma Sanjay.
9. Analog and Digital Communication by Singh and Sapre, TMH

**Course Title : POWER ELECTRONICS**
**Course Code: EE131503**
**L-T-P-C: 3-2-0-4**

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|---|---|
| Class Hours/week | 4 |
| Expected weeks | 12 |
| Total hrs. of classes | 36+12 = 48 |

| MODULE | TOPIC | COURSE CONTENT | HOURS |
|---|---|---|---|
| 1 | **SEMICONDUCTOR POWER DEVICES** | (i) Power diodes, Power transistors, MOSFET, IGBT, UJT - their operating principles, structure and characteristics.<br>(ii) Thyristors – Classification, Construction, Working principle, V-I characteristics, gate characteristics, turn-on and turn-off methods, Switching characteristics, Ratings, Protections, Mounting and Cooling.<br>(iii) Series and parallel operation of SCRs. TRIAC -characteristics, modes of operation. GTO - operation. Triggering and control circuits. | 10 |
| 2 | **CONVERTER OPERATION WITH SCRS** | (i) **Single phase controlled rectifiers** - half-wave, full-wave and bridge fully controlled, half controlled circuits with R, RL, RL with freewheeling diode, RL with voltage source loads.<br>(ii) **Three - phase controlled rectifiers** – half-wave and bridge circuits, six-pulse converter, fully controlled and half-controlled circuits with R and RL loads. Effects of load and source inductance.<br>(iii) Dual converter and Cycloconverter operating modes. Line commuted inverters, firing and control circuits for different operations. AC voltage controller. | 10 |
| 3 | **SCR COMMUTATION CIRCUITS AND INVERTERS** | (i) Commutation schemes (different classes), Forced commutation circuits.<br>(ii) **Single-phase and Three-phase Inverters** – series, parallel and bridge inverters, PWM inverter with square and sin wave output. McMurray and McMurray-Bedford inverter circuits.<br>(iii) Voltage and current source inverters. Output voltage control, harmonics eliminations. Firing circuits for inverters. | 10 |

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| 4 | **CHOPPERS** | (i) Principles of operation, classification, DC, AC, and multi- quadrant choppers.<br>(ii) Buck, Boost, Buck-Boost converters. Jones and Morgan's choppers. Application. | 10 |
| 5 | **APPLICATIONS** | (i) Switched mode power supply (SMPS), Uninterruptible power supply (UPS), SCR battery chargers<br>(ii) Induction heating, Dielectric heating. | 8 |
| | | **TOTAL** | **48** |

**TEXTBOOKS / REFERENCES:**


1. Power Electronics - Sen, P.C. - Tata Mc Graw Hill.
2. Power Electronics - P S Bimbhra -Khanna Publishers.
3. Power Electronics - M D Singh and K B Khanchandani -Mc Graw Hill.
4. Power Electronics, Circuits, Devices and Applications - Rashid M.H. - Prentice Hall of India.
5. Modern Power Electronics and AC Drives - B. K. Bose - Pearson Education.
6. Power Electronics - K. Hari Babu – SCITECH.

**Course Title : MICROPROCESSOR AND APPLICATIONS**
**Course Code: EC131504**
**L-T-P-C: 3-2-0-4**

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| Class Hours/week | 4 |
| Expected weeks | 12 |
| Total hrs. of classes | 36+12 = 48 |

| MODULE | TOPIC | COURSE CONTENT | HOURS |
|---|---|---|---|
| 1 | **INTRODUCTION** | Evolution of microprocessors, technological trends in microprocessor development. The Intel family tree. CISC Versus RISC. Applications of microprocessors. 8086 CPU ARCHITECTURE: 8086 Block diagram, description of data registers, address registers, pointer and index registers, PSW, Queue, BIU and EU. 8086 Pin diagram descriptions, generating 8086 CLK and reset signals using 8284, WAIT state generation. Microprocessor BUS types and buffering techniques, 8086 minimum mode and maximum mode of operation. | 10 |
| 2 | **8086 INSTRUCTION SET** | Instruction formats, addressing modes, data transfer instructions, string instructions, logical instructions, arithmetic instructions, transfer of control instructions. Stack Manipulation, Call and return instructions, REP Prefix, Segment override prefix, and simple assembler directives such as label, Variable, DB,DW, DD, EQU, END, Assume, Pointer (byte, Word, Double Word, Near, Short, and Far)<br>8086 PROGRAMMING TECHNIQUES: Assembly Language programs for logical processing, arithmetic processing, timing delays, loops, data conversions. Procedures, data tables, modular programming. Macros, byte and string manipulation, I/O programming. | 15 |
| 3 | **MAIN MEMORY SYSTEM DESIGN** | Memory devices, 8086 CPU Read/Write timing diagrams in minimum mode and maximum mode. Address decoding techniques. Interfacing SRAMS, ROMS/PROMS. Interfacing and refreshing DRAMS. DRAM Controller –TMS4500. | 9 |
| 4 | **BASIC I/O INTERFACE** | Parallel and Serial I/O Port design and address decoding. Memory mapped I/O Vs Isolated I/O, Intel's 8255 and 8251- description and interfacing with 8086. Interfacing ADCs, DACs, Keyboards, alphanumeric displays, multiplexed displays, and high power devices with 8086. INTERRRUPTS AND DMA: Interrupt driven I/O. 8086 Interrupt mechanism: interrupt types and interrupt vector table. Intel's 8259. DMA operation. Intel's 8237. | 14 |
| | | **TOTAL** | **48** |

***TEXT / REFERENCE BOOKS:***


1. D.V.Hall, Microprocessors and Interfacing, McGraw Hill 2nd ed.
2. J Uffenbeck, The 8086/8088 family, (PHI).
3. Liu,Gibson , Microcomputer Systems – The 8086/8088 family, (2nd Ed-PHI).

4. Douglas V.Hall, Microprocessor and Interfacing, 2nd Edition, TMH.
5. W. A. Triebel and A. Singh, The 8088 and 8086 Microprocessor Programming: interfacing Software and hardware applications, PHI.
6. B. B. Brey, The Intel microprocessor: 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium processor, Pearson Education India.

**Course Title : DIGITAL SIGNAL PROCESSING**
**Course Code: EC131505**
**L-T-P-C: 3-0-0-3**

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| Class Hours/week | 3 |
| Expected weeks | 12 |
| Total hrs. of classes | 36 |

| MODULE | TOPIC | COURSE CONTENT | HOURS |
|---|---|---|---|
| 1 | **INTRODUCTION** | What is DSP, block diagram of DSP System, its application and advantages<br><br>**Discrete time signals (an overview):** Concept of discrete time signals, basic idea of sampling and reconstruction of signals, sequences-periodic, energy, power, unit sample, unit step, unit ramp, real and complex exponentials, arithmetic operation and sequences | 4 |
| 2 | **LTI SYSTEMS (AN OVERVIEW)** | Definition, representation, impulse response, derivation of the output sequence, linear convolution, graphical and analytical method, stability and causality condition, recursive and non-recursive systems, FIR and IIR systems<br>Linear Time Invariant (LTI) systems characterized by constant coefficient difference equations. | 4 |
| 3 | **Z TRANSFORM** | Definition of z transforms and Region of Convergence (ROC), Properties of ROC and Z transform. Inverse Z transform by power series expansion method, partial fraction method, contour integration or residue method.<br><br>**Analysis of LTI Discrete Time Sequence using z transform:** Transfer function of LTI discrete time system, Impulse response and transfer function, response of LTI discrete time system using z transform, convolution and deconvolution using z transform, causality and stability of LTI discrete time system, characterization of LTI discrete time system by linear constant coefficient difference equation, determination of poles and zeros of rational z transform. | 6 |
| 4 | **REALIZATION OF DIGITAL FILTERS IN BLOCK DIAGRAM AND SIGNAL FLOW GRAPH REPRESENTATION** | **IIR filters:** Direct form I, Direct Form II, cascade, parallel and ladder form structure<br>**FIR Filters:** Direct Form structure, Cascade form structure, Linear phase FIR structure | 3 |

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| 5 | **a) DISCRETE TIME FOURIER TRANSFORM (DTFT) OR SIMPLY FOURIER TRANSFORM OF A DISCRETE TIME SIGNAL**<br><br>**b) TRANSFER FUNCTION OF LTI DISCRETE TIME SYSTEM IN FREQUENCY DOMAIN** | Definition: Frequency Spectrum of discrete time signals, Magnitude and phase spectrum, Inverse Discrete time Fourier Transform, Comparison of Fourier Transform of discrete and continuous time signal, properties of Discrete Time Fourier transform<br><br>Frequency response of LTI discrete time system, properties of Frequency response | 4 |
| 6 | **a) REPRESENTATION OF PERIODIC SEQUENCES**<br><br>**b) FOURIER REPRESENTATION OF FINITE DURATION SEQUENCES** | Discrete Fourier series, Properties of Discrete Fourier Series, Periodic convolution<br><br>Discrete Fourier Transform (DFT), Properties of DFT, Circular Convolution, Linear Convolution using DFT, relation between DFT and z transform | 4 |
| 7 | **EFFICIENT COMPUTATION OF DFT** | Fast Fourier Transform (FFT), Decimation in time FFT algorithm: In place Computation, Decimation in Frequency FFT algorithm: in place computation | 3 |
| 8 | **a) DESIGN OF DISCRETE TIME IIR FILTERS FROM CONTINUOUS TIME FILTERS**<br><br>**b) BASIC LOWPASS ANALOG FILTER APPROXIMATION** | i) Impulse Invariance Method: transformation of analog system function $H_a$ (s) to digital system function H(Z). Relation of s-plane to z plane. Design steps for Impulse Invariance method. Drawback of Impulse Invariance Method<br>ii) Bilinear transformation method: Comparison of Impulse Invariance Method and Bilinear transformation method<br><br>i) Butterworth filter approximation<br>ii) Chebyshev filter approximation<br>iii)Elliptic filter approximation | 5 |
| 9 | **FIR FILTER DESIGN** | i)Ideal Frequency Response of Linear Phase FIR filters: Characteristics of FIR Filters with linear phase<br>ii) Design of Linear Phase FIR filter using windows | 3 |

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| | | iii)Commonly used windows: Rectangular window, Hamming window, Hanning window, Blackman window | |
| | | **TOTAL** | **36** |

**TEXT BOOKS:**


1. A Nagoorkani, "Digital Signal Processing", McGraw Hill Education (India) Pvt. Ltd (2e)
2. J.G.Proakis, D.G. Manolakis and D. Sharma, "Digital Signal Processing: Principles, Algorithm and Application", Pearson
3. P.Ramesh Babu, "Digital Signal Processing", Scitech


**REFERENCES:**


1. A. V. Oppenheim, R.W. Schafer and J.R. Buck, "Discrete Time Signal Processing", Pearson
2. S.K.Mitra," Digital Signal Processing: A Computer based Approach", TMH (4e)
3. S. Salivahannan, A. Vallabraj and C. Gnanapriya, "Digital Signal Processing", TMH, 2e
4. M.H. Hayes, "Digital Signal Processing", Schaum's Outline, TMH, 2e

**Course Title : PRINCIPLES OF MANAGEMENT**
**Course Code: HS131506**
**L-T-P-C: 2-0-0-2**

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|---|---|
| Class Hours/week | 2 |
| Expected weeks | 12 |
| Total hrs. of classes | 24 |

| MODULE | TOPIC | COURSE CONTENT | HOURS |
|---|---|---|---|
| 1 | **MANAGEMENT** | Definition, nature, importance, evolution of management thoughts – pre & post scientific era, contributions made by Taylor, Fayol, Gilbreth,Elton Mayo, McGregor, Maslow – covering Time & Motion Study, Hawthrone Experiments; Is management a science or art? Functions of manager, ethics in managing and social responsibility of managers. | 4 |
| 2 | **PLANNING & CONTROL** | Why Management process starts with planning, steps in planning, planning premises, types of planning, barriers to effective planning, operational plan, strategic planning, Mckinsey's 7's Approach, SWOT analysis, Controlling-concept, Planning- control relationship, process of control, human response to control, dimension of control, MBO. | 4 |
| 3 | **DECISION MAKING & ORGANIZING** | Nature, process of decision making, decision making under Certainty and Uncertainty, decision-tree, group-aided decision, brain-storming. Organizing – concept, nature and process of organizing, authority and responsibility, delegation and empowerment, centralization and decentralization, concept of departmentation. | 4 |
| 4 | **STAFFING & MOTIVATION** | Concept, Manpower planning, Job design, recruitment & selection, training and development, performance appraisal, motivation, motivators and satisfaction, motivating towards organizing objectives, morale building. | 3 |
| 5 | **LEADERSHIP & COMMUNICATION** | Defining leadership and its role, should managers lead, leadership style, leadership development, Leadership behaviour. Communication- Process, Bridging gap-using tools of communication, electronic media in Communication. | 3 |
| 6 | **FINANCIAL MANAGEMENT** | Financial functions of management, Financial Planning, Management of Working Capital, Sources of Finance. | 3 |

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| 7 | **MARKETING MANAGEMENT** | Functions of Marketing, Product Planning & Development, Marketing Organization, Sales Organization, Sales Promotion, Consumer Behaviour, Marketing Research and Information | 3 |
| | | **TOTAL** | **24** |

**TEXTBOOKS / REFERENCE BOOKS:**


1. Robbins & Caulter, Management, Prentice Hall of India.
2. John R.Schermerhorn, Introduction to Management, Wiley-India Edition.
3. Koontz, Principles of Management, Tata-McGrew Hill.
4. Richard L. Daft, New Era of Management, Cengage Learning.
5. Stoner, Freeman and Gilbert. Jr., Management, Prentice Hall of India.
6. Koontz, Weihrich, Essentials of Management, Tata-McGrew Hill.
7. D.C. Bose, Principles of Management and Administration, Prentice Hall of India.

# PRACTICALS

**Course Title : CONTROL SYSTEM-I LAB**
**Course Code: EE131511**
**L-T-P-C: 0-0-2-1**
**Expected No. of weeks : 12 (approx)**

| EXPERIMENT NO. | AIM OF THE EXPERIMENT | HOURS |
|---|---|---|
| 1 | Study of various Matlab Syntax related to control system | 3 |
| 2 | Study of Matlab preliminary commands and Matlab graphics functions | 3 |
| 3 | Determination of Transfer Function | 3 |
| 4 | Determination of Poles and Zeroes of Transfer Function | 3 |
| 5 | Study of different time response functions related to control system | 3 |
| | **TOTAL** | **15** |

**Course Title : COMMUNICATION THEORY LAB**
**Course Code: AI131512**
**L-T-P-C: 0-0-2-1**
**Expected No. of weeks : 12 (approx)**

| EXPERIMENT NO. | AIM OF THE EXPERIMENT | HOURS |
|---|---|---|
| 1 | Study of DSB-SC: Modulation and Demodulation | 3 |
| 2 | Study of DSB-FC: Modulation | 3 |
| 3 | Study of DSB-FC: Demodulation | 3 |
| 4 | Study of 4 bit and 8 bit ADC | 3 |
| 5 | Study of 4 bit and 8 bit DAC | 3 |
| 6 | Study of data format-NRZ(L,M), RZ and Biphasic | 3 |
| 7 | Study of PAM and TDM | 3 |
| 8 | Study of pulse code modulation and demodulation | 3 |
| 9 | Study of ASK modulation and demodulation | 3 |
| 10 | Study of PSK modulation and demodulation | 3 |
| | **TOTAL** | **30** |

**Course Title : POWER ELECTRONICS LAB**
**Course Code: EE131513**
**L-T-P-C: 0-0-2-1**
**Expected No. of weeks : 12 (approx)**

| EXPERIMENT NO. | AIM OF THE EXPERIMENT | HOURS |
|---|---|---|
| 1 | Study of Power devices – power BJT, SCR, power MOSFET, IGBT etc. | 3 |
| 2 | Characteristics of SCR, TRIAC and MOSFET. | 3 |
| 3 | Load voltage control using R, RC and UJT- Triggering of SCR – (Half wave and Full wave). | 3 |
| 4 | Load voltage control using RC- triggering of TRIAC using Lamp Load. | 3 |
| 5 | Single phase fully controlled SCR bridge circuit – R load, RL load – effect of freewheeling diode. | 3 |
| 6 | Speed control of DC motor using SCR. | 3 |
| 7 | Voltage/Power control of a load using PWM technique. | 3 |
| 8 | PID control of PMDC motor with Speed measurement and Closed Loop Control. | 3 |
| 9 | Triggering circuits for SCR chopper. | 3 |
| 10 | Study of UPS/SMPS. | 3 |
| | **TOTAL** | **30** |

**Course Title : MICROPROCESSOR AND APPLICATIONS LAB**
**Course Code: EC131514**
**L-T-P-C: 0-0-2-1**
**Expected No. of weeks : 12 (approx)**

| EXPERIMENT NO. | AIM OF THE EXPERIMENT | HOURS |
|---|---|---|
| 1 | Introduction to MASM and TASM. Assembling and executing the programs. | 3 |
| 2 | Programs involving data transfer instructions<br>a) Byte and word data transfer in different addressing mode<br>b) Block move with overlap and without overlap<br>c) Block exchange | 3 |
| 3 | Programs involving arithmetic and logic operation on signed and unsigned multi byte numbers<br>a) 16-bit addition and subtraction<br>b) 32 addition and subtraction<br>c) 16-bit multiplication of signed and unsigned numbers<br>d) 8-bit division of signed and unsigned numbers<br>e) 16-bit division of signed and unsigned numbers | 3 |
| 4 | Code conversions<br>a) Converting BCD into ASCII<br>b) Binary to BCD<br>c) BCD to binary | 3 |
| 5 | Program involving string manipulation<br>a) String reversal<br>b) Comparison of two strings<br>c) Program to search for a character in a string<br>d) Program to check for a palindrome | 3 |
| 6 | Programs involving branch / loop instructions<br>a) Program to find largest and smallest in a series.<br>b) Program to sort the numbers in ascending/ descending order.<br>c) Addition of n numbers | 3 |
| 7 | Program to use DOS interrupt 21H function<br>a) Program to read a character from keyboard<br>b) Reading a key without ECHO<br>c) Read a string of 10 characters from keyboard into a buffer<br>d) Display a character and string on console<br>e) Create a file, write a file<br>f) Read system date, set system date, read system time, set system time | 3 |

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| 8 | Interfacing experiments<br>a) Matrix keyboard interfacing<br>b) Seven segment display interface<br>c) Stepper motor interface<br>d) Logical controller interface | 3 |
| | **TOTAL** | 24 |

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