SH201: ENGINEERING MATHEMATICS – III

Teaching Scheme : 03L+01T; Total: 04 **Credits:** 04
Evaluation Scheme: 15 ISE 1 + 15 ISE 2 +10 ISA +60 ESE **Total Marks:**100
Duration of ESE : 03 Hrs

COURSE DESCRIPTION:

The course is intended to provide understanding of concepts of mathematics and its application to engineering. This course introduces the student to the second and higher order differential equations and their solution, function of a complex variable. Students will study the integral transforms such as Laplace transform, Fourier transforms and their inverses. Students will learn the important theorems of vector integration like Green's, Gauss', Stokes' theorems and Maxwell's equations. Students will become familiar with statistical techniques, probability distributions and complex variables. This course is designed to inculcate analytical ability among the students.

COURSE OBJECTIVES:

The objectives of offering this course is

1. to strengthen the analytical abilities of the students.
2. to make strong foundation of the integral transforms and their inverses.
3. to make students familiar with complex variable, theorems of vector integration and Maxwell's equations.
4. to create zeal of working with higher mathematics in the widespread field of engineering.

COURSE OUTCOMES:

On the successful completion of this course; student shall be able to

1. solve engineering problems using the principles of solution of differential equations.
2. understand analytic function of a complex variable and able to apply Cauchy integral theorem and residue theorem to solve contour integrations.
3. use Fourier transforms and its inverse in practical applications of electronics engineering.
4. apply Laplace transform and its inverse to solve initial value and other related problems.
5. know basic statistical techniques required for electronics engineering.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

Sr No	PO	Level of co-relation
a.	apply knowledge of basic sciences, mathematics and basic engineering courses as appropriate to the field of electronics and telecommunication engineering.	3
b.	design and conduct experiments on electronics industrial set up, as well as analyze and interpret the resulting data.	2
c.	design a component, system or process to meet the specifications and requirements within pragmatic constraints.	2

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENTS:

Higher order linear differential equations: nth order linear differential equations with constant coefficient, complementary function and particular integrals, general method, short cut method, method of variation of parameters, linear differential equations with variable coefficient: Cauchy's differential equations and Legendre's differential equations, simultaneous linear differential equations, applications: L-R-C circuits.

Laplace transform: Definition of Laplace transform, Laplace transform of elementary functions, properties of Laplace transform, Laplace transform of special functions: unit step function, Dirac-delta function and periodic functions, inverse Laplace transform: definition and properties, inverse Laplace transform by partial fraction, convolution theorem, using standard results, application of Laplace transform to linear differential equations.

Fourier transform & Z-transform: Fourier integrals, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transform, inverse Fourier transform. Z- transform: definition and properties, z- transform of elementary functions, Inverse z- transform: definition and properties, inverse z- transform by power series method, by inversion integral method, partial fraction.

Vector Calculus: Vector differentiation and its physical interpretation, vector differential operator, gradient, divergence and curl, directional derivatives, solenoidal and irrotational fields, vector identities, vector integration: line integral, surface integral, volume integral, green's lemma, gauss divergence theorem, stokes theorem.

Statistics & probability distributions: Measures of central tendency, dispersion, moments, skewness and kurtosis, correlation coefficient, lines of regression, curve fitting, method of least square, straight lines, second degree parabola, exponential and power curves. Probability distribution: binomial distribution, Poisson distribution, normal distribution,

Complex Variables: Functions of complex variables, analytic functions, C-R equations, conformal mapping, bilinear transformation, Cauchy's theorem, Cauchy's integral formula, Cauchy's residue theorem.

Text books:

1. A text book of Engineering Mathematics (Vol-I and II), P.N.Wartikar and J.N.Wartikar, 07^{th} edition, Pune Vidhyarthi Griha Prakashan, Pune, 2013.
2. A text book of Engineering Mathematics, by N.P.Bali & Manish Goyal, 09^{th} edition, Laxmi Prakashan, 2014.

Reference books:

1. Advanced Engineering Mathematics by Erwin Kreyszig, 8^{th} edition ,Willey Eastern Ltd. Mumbai, 2013.
2. Higher Engineering Mathematics by B. S. Grewal, 33rd edition , Khanna Publication, New Delhi, 1996.
3. Advanced Engineering Mathematics by H. K. Dass, 12th edition, S. Chand Publication, New Delhi, 2003
4. Higher Engineering Mathematics by B. V. Ramana, 12^{th} edition, Tata McGraw Hill, Delhi, 2011.

ET201 NETWORK ANALYSIS

Teaching Scheme: 03L+00T; Total: 03 **Credits:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

This course introduces the student to analysis and design concepts of electronic/electrical networks. The student will learn the principles and methods of analysis and synthesis of two port networks, interconnection of two port networks and related theorems. Student will study the different techniques of analysis and design of filters and attenuators. Students will also learn transient, steady state responses and frequency domain analysis of various R-L-C circuits. This course make students familiar to Laplace transform and analyze network in s domain.

DESIRABLE AWARENESS/SKILLS:

Knowledge of basic electrical engineering and their concepts.

COURSE OBJECTIVES:

The objectives of offering this course are

1to strengthen the ability of students in the field of network analysis and design including filters and attenuators.

2 to make strong foundation of time domain and frequency domain analysis.

3 to make students familiar with s domain.

COURSE OUTCOMES:

On the successful completion of this course; student shall

1know the graph theory and able to apply network theorems to different types of networks.

2be able to analyse, synthesize and convert two port networks.

3be able to analyze and design the filters and attenuators.

4know transient, steady state and frequency response of various R-L-C networks and understand the phenomena of series and parallel resonance.

5 be able to analyze network in s domain.

RELEVANCE OF PROGRAM OUTCOMES (POS)ANDSTRENGTH OF CO-RELATION:

Sr No	PO	Level of co-relation
b.	design and conduct experiments on electronics industrial set up, as well as analyze and interpret the resulting data.	2
c.	design a component, system or process to meet the specifications and requirements within pragmatic constraints.	3
d	solve problems related to electronics engineering in interdisciplinary projects.	2
e	solve industrial problems related to electronics, communication engineering, networking and maintenance of engineering systems employing electronic sub-system.	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENT:

Graph Theory and Network Theorems(ac analysis):
Introduction, tree, co-tree, twigs, links, incidence matrix, tie-set matrix, cut set matrices and their properties. Superposition theorem, Thevenin's theorem, Norton's theorem, compensation theorem, maximum power transfer theorem

Two Port Networks:
Characteristic impedance, propagation constant, image and iterative impedance, reduction of two port network to T and π network, conversion between T and π network, **c**haracterizations of two port networks in terms of impedance, admittance, hybrid and transmission parameters, inter relationships among parameter sets, reciprocity theorem, and inter-connection of two port networks: series, parallel and cascade

Resonance:
Frequency response of R-L, R-C and R-L-C circuits, series resonance, impedance and phase angle of series resonant circuit, bandwidth, quality factor, magnification in resonance, parallel resonance, resonant frequency for a tank circuit, variation of impedance with frequency, Q factor for parallel resonance circuit, magnification and reactance curves.

Filters and Attenuators:
***Filters*:** Fundamentals, frequency response in pass band and stop band, constant k prototype low pass filter, high pass filter, band pass filter, band stop filter, m-derived filters, and composite filters.
***Attenuators*:** Definition and units of attenuation, symmetrical and asymmetrical T and Π attenuator, asymmetrical L section attenuator.

Time Domain Analysis of Circuits:
Concept of transient and steady state response, dc response of R-L, R-C, R-L-C circuits, sinusoidal response of R-L, R-C and R-L-C circuit, solution of two mesh circuits with initial conditions.

Transformation of a Circuit into s-Domain:
Review of Laplace Transforms, Transformed equivalent of resistance, inductance and capacitance in the transform domain -node analysis and mesh analysis of the transformed circuit.

Text Book:

1. Circuits and Networks, Sudhakar and M. Shyam, 4th edition, Tata McGraw-Hill, 2010.
2. Networks, Lines and Fields, John Ryder, 2nd edition, Prentice Hall of India, 2006

Reference Books:

1. Network and Systems, D.Roy Choudhary, 1st edition, New Age International Publishers, 1998
2. Network Analysis, M.E. Van Valkenburg, 3rd edition, PHI Learning Private Limited, 2011.
3. Engineering Circuit Analysis, William H. Hayt, Jr., Jack E. Kemmerly Steven M. Durbin, 8th edition, McGraw-Hill, 2012

ET 205 NETWORK ANALYSIS LAB

Teaching Scheme: 02P; Total: 02 **Credit:** 01
Evaluation Scheme:50 ICA **Total Marks:** 50

Minimum ten experiments shall be performed to cover entire curriculum of course ET201. The list given below is just a guideline.

List:

1. To verify maximum power transfer theorem.
2. To verify compensation theorem.
3. To find z parameters of two port networks.
4. To find y parameters of two port networks.
5. To find transmission parameters of two port networks.
6. To verify the response of R-L series circuit to sinusoidal and dc input.
7. To verify the response of R-C series circuit to sinusoidal and dc input.
8. To design and implement constant k of low pass filter.
9. To design and implement constant k of high pass filter
10. To plot the frequency response of series resonance circuit.
11. To plot the frequency response of parallel resonance circuit.
12. To design and implement symmetrical / asymmetrical T-attenuator.
13. To design and implement symmetrical / asymmetrical π-attenuator.

Note:

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**

ET202 COMPONENTS, DEVICES AND INSTRUMENTS TECHNOLOGY

Teaching Scheme: 04L+00T, Total: 04 **Credits:** 04
Evaluation Scheme: 15 ISE1 +15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 03Hrs.

COURSE DESCRIPTION:

This course introduces the student to study different types of components such as resistors, capacitors, inductors, switches, relays, cables and connectors. The student will learn fabrication and characteristics of integrated circuits. Student will study basic definitions related to measurement and different types of AC bridges. Students will also learn different types of electronics instrument such as digital voltmeter, digital multi-meter, and true RMS meter. This course makes students familiar to different types of transducers and manufacturing process of printed circuit board.

DESIRABLE AWARENESS/SKILLS:

Knowledge of engineering physics and basic electronics engineering and their concepts.

COURSE OBJECTIVES:

The objectives of offering this course are
1to strengthen the ability of students in the field of components, devices and instruments technology 2 to make strong foundation of electronics instrument and bridges.
3 to make students familiar with transducers.

COURSE OUTCOMES:

On the successful completion of this course; student shall
1 know the different types of components.
2 be able to understand fabrication and characteristics of integrated circuits.
3 be able to understand basics of measurement and bridges .
4 know electronics instruments and transducers.
5 be able to design and manufacturing of printed circuit board.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

Sr No	PO	Level of co-relation
a.	apply knowledge of basic sciences, mathematics and basic engineering courses as appropriate to the field of electronics and telecommunication engineering.	2
d	solve problems related to electronics engineering in interdisciplinary projects.	2
e	solve industrial problems related to electronics, communication engineering, networking and maintenance of engineering systems employing electronic sub-system.	1
i	recognize the need for and have the ability to engage in perpetual learning by working on project for which they have no prior experiences and by adapting latest advancement in technology and concepts.	3

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT:

Components:

Resistors: Fixed type, carbon composition, carbon film, metal film: construction and characteristics; variable resistors, carbon potentiometer, and wire-bound potentiometer: construction and characteristics, tolerance of various resistors.

Capacitors: Fixed type, electrolytic, aluminium type, tantalum type, ceramic capacitors, polystyrene, polyester capacitors, mica capacitor and paper capacitor, variable capacitor: construction and properties of each type.

Inductors: Fixed type, air-core, ferrite-core inductors and variable inductors: construction and characteristics.

Connecting components: Switches, relays, fuses, cables and connectors - types, construction, specifications, applications and testing.

Surface Mount Devices (SMD) :Introduction to SMD components.

Integrated Circuits - Fabrication and Characteristics:

Integrated circuit technology, basic monolithic integrated circuits, epitaxial growth, masking and etching, diffusion of impurities, transistors for monolithic circuits, monolithic diodes, integrated resistors, integrated capacitors and inductors, monolithic circuit layout, additional isolation methods, large scale and medium scale integration.

Measurement and Bridges:

Measurement: Accuracy and precision, significant figures, types of errors, system of units, electric and magnetic units, international system of unit, electrical standards.

Bridges: Kelvin bridge, Maxwell bridge, Hay bridge, Schering bridge, unbalance conditions, Wien bridge and their applications.

Electronic Instruments:

Types of DVM and its general specifications, linear ramp type, integration type, dual slope integration and successive approximation type DVM, three and half digit display of digital meters, block diagram of digital multi-meter with working, true RMS meter, RF power and voltage measurement.

Transducers and applications:

Introduction, transducer types and their applications; LVDT, capacitive transducer, piezo-electric transducer, temperature measurement - electrical resistance thermometer, platinum resistance thermometer, semiconductor thermometers, thermocouples; humidity measurement using hygrometer, ultrasonic flow measurement, ultrasonic liquid measurement, measurement of liquid level using float.

Printed Circuit Boards:

Classification and manufacturing, classification of PCBs. manufacturing of basic printed circuit boards, artwork generation: basic approach to manual artwork, general design guideline for artwork preparation, artwork generation guideline, film master preparations, etching techniques and mass-soldering techniques: immersion, bubble, splash and spray etching, types of mass soldering: dip, drag, wave, reflow and vapour phase.

Text Books:

1. Basic Electronics Solid State, B. L. Therja, 1st multicoloured edition, S. Chand & Company ltd, New Delhi,2005.
2. Electronic Instrumentation, H. S. Kalsi, 9threprint, Tata McGraw Hill, 2012
3. Modern Electronic Instrumentation and Measurement Techniques, A. D. Helfrick and W. D. Cooper, Eastern Economy Edition, PHI Learning Pvt. Ltd., New Delhi, 2011.

Reference Books:

1. A Course in Electrical and Electronic Measurement and Instrumentation, A. K. Sawhney, 9thedition, Dhanpat Rai & Company, 2013.
2. Printed Circuit Board, Walter C Bosshart, 37th reprint, Tata McGraw Hill, 2012.
3. Integrated Electronics, Analog and Digital Circuits and Systems - Millman, Halkias, 8threprint, Tata McGraw Hill,2012.
4. Elements of Electronic Instrumentation and Measurement, Joseph J. Carr, 3rd edition, Fourth Impression, 2011.
5. Instrumentation Devices and Systems, C. S. Rangan, G. R. Sharma, V. S. V. Mani, 2nd edition, 21st reprint, Tata McGraw Hill,2008.

ET206 COMPONENTS, DEVICES AND INSTRUMENTS TECHNOLOGY LAB

Teaching Scheme: 02PR; Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50
ESE Duration: 03Hrs.

Minimum ten experiments shall be performed to cover entire curriculum of course ET 202. The list given below is just a guideline.

List:

1. To study of digital multi meter and its application.
2. To study true RMS meter.
3. Square wave testing, impendence matching, X & Y calibration.
4. To study and verify the measured values of resistor, capacitor, inductor.
5. To study different types of switches (SPDT, SPST, DPST, DPDT) and measure the value of resistance for open circuit and short circuit.
6. To study relays and verify its electrical characteristics.
7. To measure unknown resistance using Kelvin bridge.
8. To measure unknown capacitance using Schering bridge.
9. To measure unknown inductance using Hay bridge.
10. To measure displacement using LVDT.
11. To measure temperature using RTD/thermistor.
12. To measure water level using capacitive transducer.
13. To measure humidity using hygrometer.
14. Prepare a Printed Circuit Board of voltage regulator using IC 7805/7812.
15. Prepare a Printed Circuit Board of suitable circuit using IC 741/555.
16. Visit to SMD unit / PCB manufacturing unit (Mandatory)

Note:

- **ICA –**Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format**(S 10).**
- **ESE –** The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET203 ELECTRONIC DEVICES AND CIRCUITS

Teaching Scheme: 03L+ 00T; Total: 03 **Credits:** 03
Evaluation Scheme: 15 ISE-I + 15 ISE-II + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

This course introduces the student to semiconductor-based devices such as diodes, bipolar transistors, FETs, and related components. The student will learn the basic principles, biasing methods and applications of semiconductor devices, transistor configurations. This course provides detailed analysis of small signal low frequency amplifiers using h parameters and high frequency BJT using hybrid π model. It includes types and frequency response of amplifiers.

DESIRABLE AWARENESS/SKILLS:

Knowledge of basic electronics engineering and its concepts.

COURSE OBJECTIVES:

The objectives of offering this course are

1 to make students to understand operating principles and characteristics of various semiconductor devices/circuits.
2 to interpret significance of various active devices and strengthen the ability to use them in electronic circuits.

COURSE OUTCOMES:

On the successful completion of this course; student shall

1 know semiconductor diodes and their applications.
2 be able to analyze/design transistor biasing circuits and h parameter analysis of amplifier.
3 understand operating principles and characteristics of JFET and MOSFET and use them as an amplifier.
4 know high frequency performance of transistor.
5 know basic concepts and analyze frequency response of single stage and multistage amplifiers.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

Sr No	PO	Level of co-relation
b.	design and conduct experiments on electronics industrial set up, as well as analyze and interpret the resulting data.	2
c.	design a component, system or process to meet the specifications and requirements within pragmatic constraints.	2
d	solve problems related to electronics engineering in interdisciplinary projects.	3
e	solve industrial problems related to electronics, communication engineering, networking and maintenance of engineering systems employing electronic sub-system.	2

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT:

Semiconductor Diodes
Diode as a circuit element, DC load line, piecewise linear diode model , clipping circuit , clipping at two independent levels, clampers – positive, negative, series and shunt type, voltage multiplier circuits, switching diodes and Schottky diode – construction, operating principle, specification and applications, light emitting diode (LED), photodiodes, introduction to opto-coupler.

Bipolar Junction Transistor
BJT biasing, concept of dc and ac load line, bias stabilization, thermal runaway, thermal stabilization, BJT small signal low frequency amplifiers and its analysis using h-parameters in CE, CB and CC configuration and their comparison, h parameter conversion among CE,CC and CB configuration.

Field Effect Transistors
Introduction, types – JFET and MOSFET, construction ,characteristics, transfer characteristics, voltage-current relationship of JFET, MOSFET – types – depletion and enhancement type, construction, characteristics, transfer characteristics, voltage-current relationship of MOSFET, FET biasing – self and voltage divider biasing for JFET , depletion type and enhancement type MOSFET..

FET Amplifiers
FET small signal model, definition of g_m , μ and r_d, FET ac equivalent circuit, JFET amplifier using self bias, voltage divider bias in CS, CG and CD configuration; depletion type and enhancement type MOSFET amplifier using self bias, voltage divider bias in CS, CG and CD configuration, Introduction to BiCMOS Technology.

Transistors at High Frequency:
Hybrid π common emitter transistor model, Hybrid π conductance, Hybrid π capacitances, validity at Hybrid π model, variation of Hybrid π parameters - f_α, f_β and f_T common emitter short circuit current gain with resistive load, single stage CE amplifier response, gain bandwidth product, emitter follower at high frequency.

Frequency response of amplifiers
Basic concepts – gain curve and phase shift curve, bandwidth, Square wave testing of amplifiers – rise time and tilt, correlation of sine and square wave testing, types of coupling, analysis of output waveform, and frequency response of RC coupled amplifiers, effects of coupling and bypass capacitors on frequency response, gain bandwidth product, multistage amplifier – cascade and cascode configurations, frequency response of multistage amplifier.

Text Book:

1. Integrated Electronics – Analog and Digital Circuits and Systems, Jacob Millman, Christos C. Halkias, 1991 edition, 48th reprint, Tata McGraw-Hill Education, 2008.
2. Electronic Devices and Circuits Theory, Robert L. Boylestad, Louis Nashelsky, 9th Edition, Prentice Hall of India, 2006.

Reference Books:

1 Electronic Devices and Circuits, David A.Bell, 5th Edition, Oxford University Press, 2008
2 Microelectronics Circuits, Adel Sedra, Kenneth C. Smith, 6th Edition, Oxford University Press, 2010

ET207 ELECTRONIC DEVICES AND CIRCUITS LAB

Teaching Scheme: 02P; Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50
ESE Duration: 3 Hrs

Minimum ten experiments shall be performed to cover entire curriculum of course ET203. The list given below is just a guideline.

List:

1. To plot the output characteristics of various clipper circuits.
2. To plot the output characteristics of various clamper circuits.
3. To plot characteristics of emitter bias / voltage divider bias circuit and determine the operating point.
4. To plot input and output characteristics of CB bipolar transistor.
5. To plot input and output characteristics of CE bipolar transistor.
6. To plot drain/transfer characteristics of JFET, enhancement and depletion type.
7. To plot drain/transfer characteristics of n-channel / p- channel MOSFET.
8. To plot frequency response of RC coupled amplifier.
9. To plot response of MOSFET amplifier in voltage divider bias for common source configuration with and without drain bypass capacitor.
10. To measure rise time and tilt for square wave testing of Common emitter amplifier.
11. To plot frequency response of multistage amplifier for cascade and cascode configuration.
12. To find out f_β and f_T with resistive load of a single stage CE amplifier.

Note:

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**
- **ESE –** The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET204: DIGITAL ELECTRONICS

Teaching Scheme: 03L+00T; Total: 03 **Credits:** 03
Evaluation Scheme: 15 ISE1+ 15 ISE2+ 10ISA+ 60 ESE **Total Marks:** 100
ESE Duration: 3Hrs

COURSE DESCRIPTION:

This course introduces the student to study electronic circuits that are used to process and control digital signals. This course introduces to various number systems and their inter-conversions, the methods for simplifying Boolean expressions. The major focus of this course is to expose students to the design process of combinational and sequential logic design. Student will able to analyze and design digital combinational circuits like decoders, encoders, multiplexers and de-multiplexers including arithmetic circuits. Students will get knowledge of the digital logic families and memory devices. This course make students to understand the importance and need for verification, testing of digital logic and design for testability.

DESIRABLE AWARENESS/SKILLS:

Knowledge of basic electronics and basic electrical engineering.

COURSE OBJECTIVES:

The objectives of offering this course are
1 to make strong foundation of number system and various codes.
2 to strengthen the ability of students in the field of digital circuit analysis and design.
3 to make students familiar with logic families, programmable logic devices and VLSI.

COURSE OUTCOMES:

On the successful completion of this course; student shall
1 know common forms of number representation and their inter-conversions.
2 be able to implement logical/arithmetic operations using combinational logic circuits.
3 be able to apply concept of sequential circuits and memories for digital system design.
4 be able to verify, test and design any digital logic circuit.
5 be able to simulate simple digital circuit in VHDL using behavioral modeling.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

Sr No	PO	Level of co-relation
b	design and conduct experiments on electronics industrial set up, as well as analyze and interpret the resulting data.	3
c	design a component, system or process to meet the specifications and requirements within pragmatic constraints.	3
d	solve problems related to electronics engineering in interdisciplinary projects.	2

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT:

Number Systems and Codes:

Types – Decimal, binary, octal and hexadecimal, representation of signed binary numbers, binary mathematics, binary codes – types - BCD Codes, excess-3 Codes, gray codes ,ASCII codes, error detecting and correcting codes,

Digital Logic Families:

Characteristics of logic families, types - introduction to all types in brief, detail study of TTL (54XX/74XX), ECL and CMOS logic families & their characteristics and comparison

Combinational Logic Circuits:

Concept of combinational and sequential circuit, Boolean algebra, simplification of Boolean expression using k-map method (up to 4 variables) and its implementation using min term (SOP) /max term (POS) expression/universal gates half & full adder/ subtractor (7483) circuits, parallel adder BCD adder/subtractor, 1 bit/2bit digital comparator(7485), code convertors binary to gray, gray to binary, BCD to 7-Segment, MUX(74151) and De-MUX(74154) and their applications, arithmetic and logic unit(74181).

Sequential Circuits and Counters:

Flip-Flops - S-R, J-K, master slave J-K flip flop, T, D, & their applications, conversion of flip flops, shift register & their applications; counters – types – asynchronous and synchronous counters, design of MOD-N synchronous and asynchronous counter, 4bit UP/DOWN asynchronous counter, ring counter and Johnson counter.

Semiconductor Memory:

Introduction, memory organization and operation, expansion of memory, classification and types of memory, read write memory, random access memory (RAM), static RAM and dynamic DDR, multiport RAM, read only memory (ROM), programmable read only memory (PROM), erasable programmable read only memory (EPROM) and flash memories, content addressable memory, first in first out (FIFO) memory, charge coupled devices memory.

Introduction to VHDL:

History, capabilities, hardware abstraction, basic terminology, entity declaration, architecture body, configuration declaration, package declaration, package body, model analysis, simulation, identifiers , data objects, data types, operators, behavioral modeling:- variable assignment statement, signal assignment statement, if statement, case statement, null statement, loop statement, exit statement, next statement, assertion statement.

Text Books:

1. Modern Digital Electronics, R.P. Jain, 4th edition, Tata McGraw - Hill Education, 2010.
2. A VHDL Primer ,J.Bhasker, 3rd edition, PHI Learning, 2009

Reference Books:

1. VHDL Programming by Example, Dougler L. Perry, 4th edition, Tata McGraw Hill, 2011
2. Leach, Malvino, Digital Principals and Applications, 5th edition, Tata McGraw Hill, 2002.

ET208: DIGITAL ELECTRONICS LAB

Teaching Scheme: 02P; Total: 02 **Credit: 01**
Evaluation Scheme: 25 ICA+25 ESE **Total Marks: 50**
ESE Duration: 3Hrs

Minimum six experiments from Group A and minimum four experiments from Group B shall be performed to cover entire curriculum of course ET204. The list given below is just a guideline.

GROUP A

1. Implement Boolean expression using universal gates.
2. Design 4 bit gray to binary code convertor.
3. Realization of IC7483 as parallel adder /subtractor.
4. Verification of 4-bit magnitude comparator using IC7485.
5. Design and implement BCD to 7 segment display decoder.
6. Verify the truth table of multiplexer and de-multiplexer using ICs.
7. Verify arithmetic and logical operations using ALU using IC74181.
8. Verify the truth table of JK,T and D Flip-Flops using IC's

GROUP B

1. Design ripple counter using IC.
2. Design decade counter using IC.
3. Implementation of basic gates using VHDL.
4. Verify any two combinational circuits using VHDL.
5. Verify any two sequential circuits using VHDL.

Note:

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**
- **ESE –** The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

SH 204 GENERAL PROFICEINCY-II

Teaching Schemes: 01 L + 02PR; Total: 03 **Credits:** 02
Evaluation Scheme:25 ICA + 25 ESE **Total Marks:** 50

COURSE DESCRIPTION:

This course is mainly designed to inculcate human skills among students community. It includes both soft skill development and human behaviour at work. The student will learn the speaking, listening, drafting and presentation skills. Student will study the organization of meeting, GD/PI principles, general etiquettes & manners and organizational communication. This course will help to develop thinking ability, positive attitude, leadership ability, emotional competence and to perform well under varied circumstances.

DESIRABLE AWARENESS/SKILLS:

Basic principles of communication and English as a language.

COURSE OBJECTIVES:

The objectives of offering this course are
1. to strengthen the persona of student.
2. to learn use of concepts and applications of ICT based presentation skills.
3. to sharpen the soft skills to enhance employability.

COURSE OUTCOMES:

On the successful completion of this course; student shall be able to
1. apply basic knowledge of public speaking, listening and presentation skills
2. draft a document and write a technical/non-technical report.
3. demonstrate good etiquettes and manners in his/her life and face GD/PI confidently.
4. understand the organizational human behaviour
5. use ICT based presentation.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

Sr No	PO	Level of co-relation
f.	understand and adapt universal skills and culture without losing human and ethical values.	2
g.	communicate (oral and written) effectively both individually and within multidisciplinary teams.	3
h.	understand and apply contextual knowledge to assess and solve social, health, safety, legal cultural and environmental issues related to engineering practices in general and electronics engineering practices in particular.	1
m.	maintain quality, timeliness and continuous improvement.	2

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENT:

Managerial Skills Development: Nature & Concepts, objectives, significance, Managerial Skills, Employability Skills, Soft Skills and Technical Skills

Self Management: Self Evaluation, Self Discipline, Self Criticism, Recognition of one's own limits and deficiencies, Independency etc., Thoughtful & Responsible, Self Awareness, emotional intelligence, emotional quotient.

Time Management Skills: Introduction, Concept of Time Management-Importance of Time Management, Analysis and Diagnosis of the Use of Time, Steps in Time Management, Techniques of Time Management, Hurdles to Effective Time Management Attendance, Discipline & Punctuality, Act in time on commitment, Quality/ Productive Time,

Entrepreneur & Entrepreneurship
Evolution of the term entrepreneur, definition of an entrepreneur, entrepreneurs and managers, traits of a true entrepreneur, characteristics of a successful entrepreneur, classification of entrepreneurs, functions of an entrepreneur, problems faced by entrepreneurs, Concepts of entrepreneurship, myths of entrepreneurship, stages in the entrepreneurial process, barriers to entrepreneurship,

Business Letters and Reports: Types of business letters, writing routine and persuasive letters, positive and negative messages; writing reports - purpose, kinds and objectives of reports; organization and preparing reports, short and long reports; writing proposals: structure & preparation; writing memos.

Group Communication: Meetings- planning, objectives, participants, timing, venue of meetings; meeting documentation: notice, agenda, agenda notes, book of enclosures and resolution & minutes of meeting.

Presentation skills: Elements of presentation – designing and delivering business presentations, advanced technological support for presentation, computer based power point presentation.

Employment communication: Introduction, Composing Application, Writing CVs, Group discussions, Interview skills, do's and don'ts at GD/PI; technology-enabled communication - communication networks, intranet, internet, videoconferencing.

Organizational Behavior: Definition, historical development, fundamental principles of OB, contributing disciplines, challenges and opportunities

Individual Behavior: Foundations of individual behavior. Ability: Intellectual abilities, Physical ability, the role of disabilities.

Personality: Meaning, formation, determinants, traits of personality, big five and MBTI, personality attributes influencing OB.

Attitude and Perception: Formation and components of attitudes, positive attitude, impact of attitude on behavior and decision making, Process of perception, factors influencing perception, link between perception and individual behavior/decision making.

Emotions: Affect, mood and emotion and their significance, basic emotions, , emotion management at individual and group level.

Motivation: Meaning and significance; theories of motivation-needs theory, two factor theory; application of motivational theories.

Group Behavior: Definition, types, formation of groups, building effective teams; conflict: meaning, nature, types, process of conflict, conflict resolution.

- **Guest lecture by industry persons based on the syllabus.**

Topics for Assignment /Practical

Minimum ten number of assignments/practical shall be performed to cover entire curriculum of the course. The list given below is just a guideline.

1. Speech preparation and delivery.
2. Power point presentation on general topics/ latest trends
3. Preparation of meeting agenda/ conducting meeting / taking minutes of meeting and preparing related documents.
4. Demonstration of general etiquettes and manners through role playing.
5. Demonstration of attitude/leadership etc through role playing.
6. Writing application letter along with resume
7. Preparing notice/ circular/ memo/ enquiries/ quotations
8. Conducting group discussions
9. Personnel interview
10. Report writing/Paper presentation.
11. Determination of emotion quotient/Intelligent quotient and personality analysis.
12. Prepare business plan/ report

Text Books:

1. Business Communication for Managers, Penrose, Rasberry, Myers, 5th edition, Cenage Learning, 2007
2. Business Communication, Rai and Rai, 2nd edition, Himalaya Publishing House, 2014
3. Organization Behavior, Suja R. Nair, Himalaya Publications, 2014
4. Organization Behavior, V.S.P.Rao, 1st edition, Excel Publications, 2009
5. Entrepreneurship Development small business Enterprises by Poornima Charantimath- Pearson, 1st Edi. Reprint, 2005.

Reference Books:

1. Business Communication, Raman and Singh, 2nd edition, Oxford Publication, 2012
2. Business Communication Today, Bovee, Thill, 6th edition, Schatzman, Pearson Education, 2000
3. Business Communication (BCOM), Lehman Sinha, 2nd edition, Cengage Learning, 2012
4. Organization Behavior, Stephen P. Robbins, 13th edition, Pearson Education, 2009
5. Organization Behavior, Fred Luthans, 12th edition, TMH, 2012
6. Organization Behavior, K. Ashwathappa, 7th edition, Himalaya Publications, 2007
7. Soft skills Training – A workbook to develop skills for employment by Fredrick H. Wentz
8. Personality Development and Soft skills , Oxford University Press by Barun K. Mitra
9. The Time Trap : the Classic book on Time Management by R. Alec Mackenzie

NOTE:

- **ICA** – Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).
- **ESE** – The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET251 SIGNALS AND SYSTEMS

Teaching Scheme: 03L+ 00 T; Total: 03 **Credits:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

This course is designed to lay the foundation for further studies in areas such as communication, signal processing, and control systems etc. This course will explore the basic concepts of signals and systems. Students will understand and learn various types of signals, signal operations and representation of signal and system in time and frequency domain using Fourier and Laplace transform. In this course, more emphasis is given on analysis of continuous time signals and systems.

DESIRABLE AWARENESS/SKILLS:

Knowledge of basic electrical engineering, electrical network and fundamentals of complex numbers.

COURSE OBJECTIVES:

The objectives of offering this course are
1. to make strong foundation of basics of signals and systems.
2. to strengthen ability of students to analyze signals and systems in time domain and frequency domain
3. to make students familiar with applications of signals and systems in other areas of electronics engineering.

COURSE OUTCOMES:

On the successful completion of this course; student shall
1. Understand the basic signals, systems and their classification, and perform operations on signals.
2. Analyze the CTLTI and DTLTI system in time domain and determine stability, memory and causality of system using impulse response.
3. Analyze signals and systems in frequency domain using Fourier series and Fourier transform and its properties.
4. Analyze signals and systems in complex frequency domain using Laplace Transform. Analyze the system in s – domain and apply Laplace transforms to analyze electrical circuits.
5. Understand, and evaluate the correllogram, auto correlation, cross correlation, energy spectral density, and power spectral density of discrete and continuous signals.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

Sr No	PO	Level of co-relation
a	apply knowledge of basic sciences, mathematics and basic engineering courses as appropriate to the field of electronics and telecommunication engineering.	3
e	solve industrial problems related to electronics, communication engineering, networking and maintenance of engineering systems employing electronic sub-system.	2

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT:

Introduction to Signals and Systems

Concept of signals and systems, classification of signals: single dimensional and multidimensional, single channel and multichannel, continuous time and discrete time, even, odd, periodic and non-periodic, deterministic and non deterministic, energy and power.

Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration (Accumulator for DT), time scaling, time shifting and folding, precedence rule.

Elementary signals: impulse, step, exponential, sine, ramp, rectangular, triangular, signum, sinc.

Classification of systems: static and dynamic, causal and non-causal, time variant and invariant, linear and non linear, stable and unstable, invertible.

System Analysis in Time Domain

System modelling: Input output relation, block diagram, impulse response, convolution integral, convolution sum, computation of convolution integral using graphical method for unit step to unit step, unit step to exponential, exponential to exponential and unit step to rectangular, rectangular to rectangular only, computation of convolution sum, properties of convolution, system interconnection, system properties in terms of impulse response, step response in terms of impulse response.

System Analysis in Frequency Domain using Fourier Transform

Definition and necessity of CT and DT Fourier series and Fourier transforms, analogy between CTFS, DTFS and CTFT, DTFT, CT Fourier series, CT Fourier transform and its properties, problem solving using properties, amplitude spectrum, phase spectrum of the signal and system, conversion between time and frequency domain using continuous sinc and continuous rectangular signals, limitations of FT.

System Analysis in Frequency Domain using Laplace Transform

Definition of Laplace transform and concept of RoC, properties of Laplace transform, numerical based on properties, pole zero concepts and concept of system function, system properties based on RoC of system function, inversion of Laplace transform, unilateral Laplace transform, application of Laplace transform to the LTI system analysis.

Correlation and Spectral Density Definition of Correlation, correllogram, auto-correlation, cross correlation, analogy between correlation, and convolution, properties of correlation , energy/power spectral density, inter relation between correlation and spectral density.

Text Books:

1. Signals and Systems, Simon Haykins and Barry Van Veen, 2nd Edition, Wiley India, 2007.
2 Fundamentals of Signals and Systems, M.J.Roberts and Govind Sharma,2nd edition, McGraw Hill, 2010

Reference Books:

1. Continuous and Discrete Time Signals and Systems, Mrinal Mandal and Amir Asif, Cambridge University Press, 2007
2. Signals, Systems and Transforms, John Parr, Charles L. Phillips, Eve Riskin, 4th Edition, Pearson Education, 2014.
3. Getting Started with MATLAB (Updated version for 7.8-Release 2009), Oxford University Press,2010

ET256 SIGNALS AND SYSTEMS LAB

Teaching Scheme: 02P; Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA **Total Marks:**25

Minimum ten experiments (3 from group A and 7 from group B) shall be performed to cover entire curriculum of courseET251 using simulation software like MATLAB/Scilab/Octave. The list given below is just a guideline.

List:

Group A (Minimum 3 Experiments)

1. Introduction to MATLAB/Scilab/Octave. (Arrays; initialization and basic operations)
2. MATLAB/Scilab/Octave basic functions (Minimum 20 functions)
3. Use of decision control statements and loops in MATLAB/Scilab/Octave.
4. User defined functions in MATLAB/Scilab/Octave

Group B (Minimum 7 Experiments)

5. Generation of standard continuous and discrete signals.
6. Operations on signals of unequal length.
7. Convolution of two sequences (with and without using standard functions).
8. Fourier synthesis of square/triangular wave.
9. Magnitude and phase spectrum of CT signal using approximation of CTFT.
10. Verification of two properties of CTFT (using approximate CTFT)
11. Frequency response of CTLTI system.
12. Correlation of two sequences (with and without using standard functions).
13. Use of simulink to generate a LTI system and observation of output.

Note:

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**

ET252 ELECTRONIC CIRCUITS AND APPLICATIONS

Teaching Scheme: 03L + 01 T; Total: 04 **Credits:** 04
Evaluation Scheme: 15 ISE-I + 15 ISE-II + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

This course aims at imparting structural and functional understanding of amplifier circuits as applicable in the area of feedback topologies and oscillators, class based amplifiers used in audio power applications, waveform generators, differential amplifier and its basic analysis. From viewpoint of practical working and design, detailed study of power management circuits built on voltage regulators, also forms integral part of the course.

DESIRABLE AWARENESS/SKILLS:

Knowledge of basic electronic devices and their electrical characteristics, basic electronic circuits and concepts of network analysis.

COURSE OBJECTIVES:

The objectives of offering this course are -

1. to impart enriched knowledge and ability of analyzing and understanding various cascaded structures of transistorized amplifiers
2. to create zeal of working with these structures as demanded in the widespread field of electronics and telecommunication
3. to enhance passion for designing these structures with professional features
4. to develop efficacy of building and handling power management circuits

COURSE OUTCOMES:

On the successful completion of this course; student shall be able to:

1. work confidently with higher and complex transistorized applications
2. suggest and implement better solutions to the field practices of power amplifiers and function generators
3. design and develop power supply modules for various gadgets

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

Sr No	PO	Level of co-relation
b.	Design and conduct experiments on electronics industrial set up, as well as analyze and interpret the resulting data.	3
c.	Design a component, system or process to meet the specifications and requirements within pragmatic constraints.	2
e	Solve industrial problems related to electronics, communication engineering, networking and maintenance of engineering systems employing electronic sub-system.	2

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENTS:

Feedback Amplifier:
Classification of amplifier, concept of feedback, types of feedback (positive & negative feedback), general characteristics of negative feedback amplifier – transfer gain, input resistance and output resistance, negative feedback amplifier - analysis of voltage series, current series, voltage shunt and current shunt negative feedback amplifier.

Large Signal Amplifier:
Introduction to power amplifier, concept of load line, performance parameter of power amplifier, classification of power amplifier, class A power amplifier with resistive load, transformer coupled class A power amplifier, efficiency of class A amplifier, push pull power amplifier, class B amplifier-with and without output transformer, concept of crossover distortion, class AB operation, second harmonic distortion and higher order harmonic generation.

Waveform Generators and Wave Shaping Circuits:-
Concept of oscillator, classification of oscillator, circuit, operation and detailed analysis of phase shift, Wien bridge, Hartley, Colpitt's, Clap and crystal oscillator. Methods of generating a time base waveform, exponential sweep RC circuit, a transistor constant current sweep, an inductor circuit used to improve the linearity of RC sweep circuit, transistor current sweep circuit, a current sweep using current feedback to improve linearity.BJT as a switch, astable, bistable and monostable multi-vibrator, Schmitt trigger circuit.

Differential Amplifiers:
Introduction of differential amplifier, different modes of differential amplifier, dc analysis of differential amplifier with Re, ac analysis of differential amplifier, calculation of CMRR for balanced and unbalanced operation, techniques to improve CMRR of differential amplifier.

Regulated Power Supply:
Introduction of voltage regulator, block diagram of regulated power supply, concept of line and load regulation, filters, types of voltage regulator, emitter follower series voltage regulator, transistorized series voltage regulator, short circuit protection circuit (using transistor and diode), fold back protection circuit with design examples.

Text Book:

1. Millman's Electronic Devices and Circuits,Jacob Millman, Christos C. Halkias, Satyabrat Jit, 3rd edition, McGraw-Hill Education (India) Private Limited, 2010.
2. Pulse,Digital and Switching Waveforms, Jacob Millman and Herbert Taub, 23rd edition McGraw –Hill international education editions, 1981.
3. Electronic Devices and Circuits Theory, Robert L. Boylestad, Louis Nashelsky, 9th Edition, Prentice Hall of India, 2006

Reference Books:

1. Electronic Devices and Circuits, David A.Bell, 5th edition, Oxford University Press, 2008
2. Microelectronics Circuits, Adel S. Sedra , Kenneth C. Smith ,Arun N. Chandorkar , 5th edition, Oxford University Press, 2009
3 Electronics Devices and Circuits, S. Salivahanan, N Sureshkumar, 3rd edition, McGraw Hill Education (India) Private Limited, 2012.

ET257 ELECTRONIC CIRCUITS AND APPLICATIONS LAB

Teaching Scheme: 02P; Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50
ESE Duration: 3 Hrs

Minimum ten experiments shall be performed to cover entire curriculum of course ET252. The list given below is just a guideline.

List:

1. To study negative feedback amplifier and measure output resistance, input resistance and transfer gain with and without feedback
2. To plot the performance characteristics of various multi-vibrator circuits.
3. To plot the performance characteristics of Schmitt trigger circuit.
4. To plot performance characteristics of class A power amplifier with resistive load.
5. To plot performance characteristics of transformer coupled class A power amplifier.
6. To measure performance parameters of Push-pull power amplifier
7. To plot performance characteristics of transistor constant current sweep generator.
8. To study line and load regulation of regulated power supply.
9. To study Wein bridge oscillator
10. To study short circuit protection and fold back protection circuit using transistor and diode and measure short circuit current.
11. To measure CMRR of emitter coupled DIDO amplifier.
12. To find out operating point of emitter coupled DIDO amplifier (dc analysis)
13. Design and implement regulated power supply. (mandatory – may require two terns)

Note:

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**
- **ESE –** The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET253: MICROPROCESSOR AND MICROCONTROLLERS

Teaching Scheme:03L+00T; Total:03 **Credits:** 03
Evaluation Scheme: 15 ISE1+ 15 ISE2+ 10ISA+ 60 ESE **Total Marks:** 100
ESE Duration: 3Hrs.

COURSE DESCRIPTION:

This course is designed to teach microprocessor 8085 and microcontroller 8051. Students will learn the architecture of 8085, addressing modes, instruction set, interrupt structure. This adequate instruction set helps student to learn necessary programming concept. This course also includes the synchronous and asynchronous data transfer schemes with memory organization in 8085. This course is designed to provide an introduction to microcontroller 8051. Student will learn block diagram, pin description, addressing mode, instruction set and different modes of 8051. Student can get the knowledge of different types of external interfaces including LEDS, LCD, Keypad Matrix, DC motor, Stepper motor and Relay with 8051. This helps students to analyze and design microcontroller based systems.

DESIRABLE AWARENESS/SKILLS:

Knowledge of digital electronics and its concepts.

COURSE OBJECTIVES:

The objectives of offering this course are to

1. give an understanding about the concepts and basic architecture of 8085 and 8051.
2. provide an overview of difference between microprocessor and micro controller.
3. impart knowledge about assembly language programs of 8085 and 8051.
4. help to understand the importance of different peripheral devices & their interfacing to 8051
5. impart knowledge of different types of external interfaces including LEDs, LCD, keypad matrix, dc motor, stepper motor and relay.

COURSE OUTCOMES:

On the successful completion of this course; student shall

1. understand the fundamentals of microprocessor 8085 systems.
2. understand the fundamentals of microcontroller 8051 systems and interface, and have the ability to apply them.
3. identify, formulate and solve problems by using the concepts of microcontroller systems and interface.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

Sr No	PO	Level of co-relation
c.	design a component, system or process to meet the specifications and requirements within pragmatic constraints.	3
d	solve problems related to electronics engineering in interdisciplinary projects.	2
e	solve industrial problems related to electronics, communication engineering, networking and maintenance of engineering systems employing electronic sub-system.	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENT:

Microprocessor 8085:
Architecture, block diagram, addressing modes, timing diagrams, state transition diagrams, classification of instructions, instruction set, assembly language programming, interrupt structure, serial data transfer program using RIM and SIM programming

Data Transfer Schemes:
Introduction to stack, subroutines, i/o mapped i/o and memory mapped i/o, synchronous and asynchronous data transfer schemes, memory interfacing, memory organization, address space, memory specification memory design using RAM and ROM .

Microcontroller 8051:
Overview of the microcontroller family, block diagram and pin description of 8051, 8 bit microprocessor/microcontroller architecture comparison - harward and von neumann architecture, addressing modes in 8051,instruction set, memory and register organization, i/o port structure and programming, stack, looping, conditional and unconditional jumps , subroutines, time delay, interrupt structure, timers and its modes & serial communication and modes.

Interfacing with 8051:
ADC(0808) interfacing with 8051 microcontroller, DAC(0809) interfacing with 8051 microcontroller, LCD and LED display interfacing with 8051 microcontroller, relay interfacing with 8051 microcontroller, stepper motor interfacing with 8051 microcontroller, DC motor interfacing with 8051 microcontroller, matrix keyboard interfacing with 8051 microcontroller

Microcontroller Based Systems:
Survey of 8 bit controllers and its features, limitation of 8 bit microcontrollers, study of RS232, RS 485, I2C, SPI protocols, software and hardware tools for development of microcontroller based system such as assembler, compiler, IDÉ, Emulators, debugger, programmer, development board.

Text Books:

1. Microprocessor, Architecture Programming and Applications with 8085, R.S. Gaonkar, ,5th edition, Penram International publication, 2004.
2. The 8051 Microcontroller, Kenneth Ayala, Delmar , 3rd edition, Cengage Learning, 2007

Reference Books:

1. Fundamentals of Microprocessors and Microcontrollers, B. Ram, 8th edition, Dhanpatrai Publications, 2010
2. The 8051 Microcontroller and Embedded Systems Using Assembly and C, Muhammad Ali Mazidi, Rolin McKinlay, Janice Gillispie Mazidi, 2nd edition, Pearson India, 2007.

ET258: MICROPROCESSOR AND MICROCONTROLLERS LAB

Teaching Scheme: 02P+00T; Total: 02 **Credit:** 01
Evaluation Scheme: 25ICA+ 25 ESE **Total Marks:** 50
ESE Duration: 3 Hrs.

Minimum ten experiments shall be performed to cover entire curriculum of course ET253. The list given below is just a guideline.

1. Arrange an array of data in ascending and descending order using 8085
2. BCD to Hex conversion using 8085.
3. Hex to BCD conversion using 8085.
4. In ASM and C
    a) Write a program to add two 8-bit numbers stored in registers or internal/External memory locations.
    b) Write a program to multiply two 16-bit numbers.
    c) Write a program to add block of data stored in internal/external memory locations.
5. Interfacing ADC and DAC with 8051 microcontroller.
6. Interfacing Matrix Keyboard with 8051 microcontroller.
7. Interfacing LED and LCD Displays with 8051 microcontroller.
8. Interfacing Stepper Motor with 8051 microcontroller.
9. Interfacing Relay with 8051 microcontroller.
10. Controlling DC motor with 8051 microcontroller.

Note:

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**
- **ESE –** The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

ET254 ANALOG COMMUNICATION

Teaching Scheme: 03L+00T; Total: 03 **Credits:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

This course provides a thorough introduction to the basic principles and techniques used in analog and pulse communication. The course will introduce communication system, analog modulation techniques, communication transmitter and receiver, noise analysis, and multiplexing techniques. The course also introduces analytical techniques of pulse modulation.

DESIRABLE AWARENESS/SKILLS:

Knowledge of basic electronics and electrical engineering.

COURSE OBJECTIVES:

The objectives of offering this course are

1. to understand and implement the basic analog communication techniques/ circuits with the help of theoretical and practical problem solving.
2. to make strong foundation of time domain and frequency domain analysis of modulation techniques.
3. to make students familiar with pulse communication.

COURSE OUTCOMES:

On the successful completion of this course; student shall

1. know the communication system and be able to analyse different types of noise.
2. be able to analyse different analog modulation techniques.
3. know techniques of transmission and reception of analog signal.
4. know pulse modulation techniques.
5. be able to analyse multiplexing techniques.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

Sr No	PO	Level of co-relation
a.	Apply knowledge of basic sciences, mathematics and basic engineering courses as appropriate to the field of electronics and telecommunication engineering.	3
b.	Design and conduct experiments on electronics industrial set up, as well as analyze and interpret the resulting data.	1
c.	Solve industrial problems related to electronics, communication engineering, networking and maintenance of engineering systems employing electronic sub-system.	2

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT:

Communication System and Noise:
Communication system, need of modulation, types of analog modulation, noise-classification of noise, external noise and internal noise, noise due to several sources, noise due to several amplifier in cascade, noise in reactive circuit, noise figure, calculation of noise figure, noise figure from measurement, noise temperature.

Amplitude Modulation
Amplitude modulation, mathematical analysis, modulation index, frequency spectrum, power equation, efficiency, generation of AM signal(Collector and Emitter modulator), AM transmitter, high and low level transmitter, principle of non-linearity, balanced modulator (using FET,BJT and IC1496), SSB generation, filter method and phase shift method for generation of SSB signal, amplitude demodulators, VSB modulation and demodulation, forms of AM, ISB generation.

Angle Modulation
Phase modulation, mathematical analysis for PM, Frequency modulation, mathematical analysis, modulation, noise triangle, pre emphasis and de-emphasis, Generation of FM, direct and indirect method, reactance and varactor diode modulator, stabilized reactance modulator, Armstrong method, narrowband and wideband FM, basic FM demodulator, balanced slope detector, phase discriminator and ratio detector.

Receivers
Characteristics of receiver, types of receiver, TRF receiver, super heterodyne receiver, AM super heterodyne receiver- RF amplifier, image frequency and its rejection, mixer-self and separately excited mixer, IF amplifier, practical diode detector, AGC and delayed AGC, FM super heterodyne receiver- comparison with AM super heterodyne receiver, amplitude limiting, performance of amplitude limiter, SSB and ISB receiver.

Pulse Modulation and Multiplexing
Sampling theorem, Types of sampling-ideal, natural, flat top sampling, quantization, concept, generation and detection - pulse amplitude modulation (PAM), pulse width modulation (PWM), pulse position modulation (PPM), pulse code modulation (PCM), companding, A-law and μ-law companding, delta modulation(DM),adaptive delta modulation(ADM), Linear predictive coding, multiplexing- frequency division multiplexing and time division multiplexing.

Text Books

1. Electronic Communication Systems, D. Kennedy, 4th edition, Tata McGraw-Hill, 1999
2. Principles of Communication Systems, Taub, Schilling and G.Saha, 3rd edition, McGraw-Hill, 1995

Reference Books

1. Communication Systems, A.Bruce Carlson , 4th edition, McGraw-Hill, 2006
2. Electronic Communication, Roddy and Coolen , 4th edition, Prentice Hall of India, 2003.
3. Communication Systems, S. Haykin, 4th edition, John wiley & Sons, 2000

ET259 ANALOG COMMUNICATION LAB

Teaching Scheme: 02P; Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA+25 ESE **Total Marks:** 50
ESE Duration: 3 Hrs

Minimum ten experiments shall be performed to cover entire curriculum of course ET254. The list given below is just a guideline.

1. Amplitude modulation (AM).
2. Amplitude demodulation.
3. Balanced modulation using IC 1496.
4. Frequency modulation (FM) (using IC/varactor diode /BJT /FET)
5. Amplitude demodulation.(using IC/ratio detector /BJT /FET)
6. Pre emphasis and de-emphasis
7. AM super heterodyne receiver
8. Radio frequency amplifier
9. IF amplifier
10. FM super heterodyne receiver
11. Flat top sampling
12. Pulse amplitude modulation.
13. Pulse width modulation
14. Pulse position modulation
15. Pulse code modulation
16. Delta modulation / Adaptive delta modulation
17. Visit to AM/FM radio station (Mandatory)

Note:

- **ICA –**Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format**(S 10).**
- **ESE –** The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

SH 255: HUMAN RESOURCE AND ECONOMICS

Teaching Scheme: 03L + 00T; Total 03 **Credits:** 03
Evaluation Scheme: 15 ISE1 + 15 ISE2 + 10 ISA + 60 ESE **Total Marks:** 100
Duration of ESE: 3 Hrs.

COURSE DESCRIPTION:

The course is intended to provide basic understanding of Economics and Human Resource to engineering students with the basic concept of economics and market structures. This course introduces the student to the fundamental concepts of Human Resource Management (HRM); the basic roles, competency, functions of HRM and basic knowledge of international HRM. Students will study the factors of production, localization of industries and forms of market structure. Students will learn nature of economic analysis, economic systems, wants, consumption and marginal utility.

DESIRABLE AWARENESS/SKILLS:

Knowledge of basic human skills and organizational behaviour.

COURSE OBJECTIVES:

The objectives of offering this course are

1. To understand the fundamental of economics
2. To develop the analytical and rational ability amongst students with the study of economics
3. To create awareness regarding global Human resource avenues
4. To understand the standards and norms of Human resource management.
5. To transform the ever changing complex issues in World Economics

COURSE OUTCOMES:

On the successful completion of this course; student shall

1. know the basic concept of economics and market structures, factors of production.
2. able to demonstrate the ability to govern the functioning of a firm/organization under different market conditions.
3. understand and implement the fundamental concepts and functions of HRM.
4. understand the existing and immerging trends in international HRM followed globally.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

Sr No	PO	Level of co-relation
h.	understand and apply contextual knowledge to assess and solve social, health, safety, legal cultural and environmental issues related to engineering practices in general and electronics engineering practices in particular.	1
i.	recognize the need for and have the ability to engage in, perpetual learning by working on projects for which they have no prior experience and by adapting latest advancement in technology and concepts.	2
j.	interpret and update with contemporary issues affecting engineering industry.	2
k.	manage the project under execution effectively and professionally using the techniques, skills, and modern engineering tools necessary for engineering practice.	2

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

COURSE CONTENT:

Human Resource Management: Meaning and definition, personnel versus HRM, significance of HRM, functions of HRM, objectives of HRM, evolution and development of HRM.

Motivation, Leadership and Ethical Issues in HRM: Motivation meaning, types, steps, Maslow's theory of hierarchy of needs, Vroom's expectancy theory of motivation, Alderfer's ERG theory; leadership, styles, trait theory, path goal theory, charismatic leadership theory; ethical issues in HRM, ethical issues in employment, ethical issues in salary administration.

Recent Trends in HRM: Competency mapping, business process outsourcing, HR balance score card, dual career couples, knowledge management, emotional intelligence, right sizing, talent management,360 degree feedback, importance of cultural sensitivity, cross cultural communication and negotiation

Nature of Economic Analysis and Economic Systems: Wealth definition, welfare definition, scarcity and growth, basic economic problems, microeconomics and macroeconomics, significance of economics, basic assumptions in economics, economics and other related sciences; capitalism, socialism, mixed economy.

Wants and Consumption and Marginal Utility: Factors influencing wants, classification of wants, scale of preferences, consumption, standard of living, concept of utility, the law of diminishing marginal utility, demand , law of demand, determinants of demand, law of supply, determinants of supply.

Factors of Production& Forms of Market (Basic Concept) and National Income: Land, labor, capital, entrepreneur, mobility of factors of production, division of labor, localization of industries; forms of market structure national income; meaning, stock and flow concept, NI at market price, NI at factor costs, GNP, GDP, NNP,NDP, personal income, disposal income.

Text books

1. Principles of economics: D.M. Mithani, 11th Edition, Himalaya Publishing, 2013
2. Essentials of Human Resource Management and IR: P. Subbarao, 3rd Edition, Himalaya Publishing, 2010
3. Fundamental of Business Economics: D.M. Mithani & G.K. Murthy, 18th Edition, Himalaya Publishing, 2013
4. India Economy, Gaurav Dutt and Ashwani Mahajan: 6th Edition, S. Chand, 2013

Reference Books

1. Strategic Human Resource Management: Charles R. Greer, 2nd Edition, Pearson Publication, 2000
2. International Human Resource Management: P.L. Rao, 1st Edition, Excel Books, 2008
3. Economic Environment of Business: S.K. Misra and V.K. Puri, 2nd Edition, Himalaya Publishing, 2000
4. Modern Economic Theory: Dr. K. K. Dewett& M. H. Navalur, 23rd Edition, S. Chand. 2014
5. Economics: Principles and Applications, Mankiw, 5th Edition, Cengage Learning, 2008

ET255 DATA STRUCTURE LAB

Teaching Scheme: 02L + 02 PR; Total: 04 **Credits:** 03
Evaluation Scheme: 25 ICA + 50 ESE **Total Marks:** 75
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

This course provides an introduction to the theory, practice and methods of data structures and algorithm design. Students will learn elementary data structures such as stacks, queues, linked lists, and trees in C language, and the algorithms designed for manipulating these data structures.

DESIRABLE AWARENESS/SKILLS:

Knowledge of Computer Fundamentals and C Programming

COURSE OBJECTIVES:

The objectives of offering this course are:

1. to introduce students to data structures and algorithm design.
2. to make students able to implement programs using variety of data structures.

COURSE OUTCOMES:

On the successful completion of this course; student shall:

1. choose the data structures that effectively model the information in a problem.
2. judge efficiency trade-offs among alternative data structure implementations or combinations.
3. apply algorithm analysis techniques to evaluate the performance of an algorithm and to compare data structures.
4. implement and know when to apply standard algorithms for searching and sorting.
5. design, implement, test, and debug programs using a variety of data structures including lists, stacks, queues, binary tree structures, search trees, graphs.

RELEVANCE OF PROGRAM OUTCOMES (POS) AND STRENGTH OF CO-RELATION:

Sr No	PO	Level of co-relation
a	Apply knowledge of basic sciences, mathematics and basic engineering courses as appropriate to the field of electronics and telecommunication engineering.	3
c.	design a component, system or process to meet the specifications and requirements within pragmatic constraints.	3
d	solve problems related to electronics engineering in interdisciplinary projects.	2

1-Weakly correlated **2 – Moderately correlated** **3 – Strongly correlated**

COURSE CONTENT:

Introduction to Algorithm & Program Design
***Fundamentals*:** Basic Terminology, elementary data organization, data Structures, data structure operations, abstract data type (ADT).
***Algorithm*:** Complexity, time space tradeoff, algorithmic notations, control structures, complexity of algorithms, sub-algorithms, searching algorithms - algorithms for sequential search, indexed sequential search and binary search.

Arrays, records and Pointers
***Sorting Algorithms*:** Selection sort, Bubble sort, Insertion Sort, Quick and Merge sort.
***Records*:** Structures in C, Comparison with arrays as a data structure, array of structures, pointers and structures, polynomial representation using array of structures, unions, bitwise operators.

Linked Lists
Singly Linked Lists: Concept, linked list as ADT, representation of linked list in memory, traversing a linked list, searching a linked list, memory allocation; garbage collection, insertion into linked list, deletion from a linked list,

Stacks, Queues, Recursion
Stacks: concept, array representation of stacks, linked representation of stacks, stack as ADT, arithmetic expressions; polish notation, application of stacks: recursion, implementation of recursive procedures by stacks.
Queues: concept, array representation of queues, linked representation of queues, queue as ADT, circular queues, de-queue (double ended queue), priority queues, and applications of queues: categorizing data, simulation of queues.

Trees
Binary Trees: Concept and terminologies, representation of binary tree in memory, traversing a binary tree, traversal algorithms using stacks, header nodes; threads, binary search trees (BST), Searching and inserting in BST, deleting in a BST**,** balanced binary trees, application of trees: expression Tree, game trees.

Practical:
Minimum ten experiments shall be performed to cover entire curriculum of this course. The list given below is just a guideline.

Write Programs in C to implement
1. set operations like union, intersection and difference.
2. searching methods-Linear & Binary
3. sorting methods-bubble, selection / insertion with complexity analysis.
4. quick Sort / merge sort with complexity Analysis.
5. data base Management using array of structure with operations: create, display, modify, append, search and sort.
6. polynomial addition using array of structure.
7. singly linked list with operations Create, Insert, Delete, and Search.
8. stack using arrays or Linked Lists.
9. queue using array or Linked Lists.
10. conversion of infix expression to postfix expression.
11. binary search tree: Create, search, recursive traversals.
12. circular queue operations.

Text Books:

1. Data Structure with C Schaum's Outlines, Seymour Lipschutz, 1st edition, McGraw Hill Education (India) Private Limited, 2010.
2. Data Structures through C, Yashavant Kanetkar, 2nd edition, BPB Publication, 2009

Reference books:

1. Programming in ANSI C, E Balgurusamy, 6th edition, McGraw Hill Education (India) Private Limited, 2012
2. Data structures using C and C++, Yedidyah Langsam, Moshe J Augenstein, Aaron M, Tenenbaum, 2nd edition, PHI Learning, 2009.
3. Data Structures using C, ISRD Group, 2nd edition McGraw Hill Education (India) Private Limited, 2012

Note:

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**
- **ESE –** The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

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Equivalent/exemption in course of S. Y. B. Tech. (E&T/C) in autonomous curriculum if passed the courses from NMU, Jalgaon curriculum.

Sr. No.	Course as per autonomous curriculum in which exemption shall be granted (Course code & name)		Exempted if Passed as per NMU, Jalgaon examination (Paper No. & Subject Code)
1	SH201	Engineering Mathematics - III	Engineering Mathematics – III (TH)
2	ET201	Network Analysis	Network Analysis and Synthesis (TH)
3	ET202	Components, Devices and Instruments Technology	Component Devices & Instrumentation Technology (TH)
4	ET203	Electronics Devices and Circuits	Solid State Devices & Circuits-I (TH)
5	ET204	Digital Electronics	Digital Techniques & Applications (TH)
6	SH204	General Proficiency II	**No Equivalence and hence no exemption (i.e. each student who is shifted from NMU, Jalgaon curriculum in to autonomous curriculum shall register and pass this**
7	ET205	Network Analysis Lab	Network Analysis and Synthesis (LAB)
8	ET206	Components, Devices and Instruments Technology Lab	Component Devices & Instrumentation Technology (LAB)
9	ET207	Electronics Devices and Circuits Lab	Solid State Devices & Circuits-I (LAB)
10	ET208	Digital Electronics Lab	Digital Techniques & Applications (LAB)
11	ET251	Signals and Systems	**No Equivalence and hence no exemption (i. e .each student who is shifted from NMU, Jalgaon curriculum in to autonomous curriculum shall register and pass this**
12	ET252	Electronic Circuits and Applications	Solid State Devices & Circuits-II (TH)
13	ET253	Microprocessor and Microcontrollers	Microprocessors (TH)
14	ET254	Analog Communication	Communication Systems-I (TH)
15	SH251	Human Resource and Economics	**No Equivalence and hence no exemption (i.e. each student who is shifted from NMU, Jalgaon curriculum in to autonomous curriculum shall register and pass this course.)**

16	ET255	Data Structure Lab	**No Equivalence and hence no exemption (i.e. each student who is shifted from NMU, Jalgaon curriculum in to autonomous curriculum shall register and pass this course.)**
17	ET256	Signals and Systems Lab	**No Equivalence and hence no exemption (ie each student who is shifted from NMU, Jalgaon curriculum in to autonomous curriculum shall register and pass this course.)**
18	ET257	Electronic Circuits and Applications Lab	Solid State Devices & Circuits-II (LAB)
19	ET258	Microprocessor and Microcontrollers Lab	Microprocessors (LAB)
20	ET259	Analog Communication Lab	Communication Systems-I (LAB)

Important Notes:

1. If any student was admitted in second year (E&Tc) before the academic year 2015-16 and his/her odd semester (I^{st} semester) was granted under NMU, Jalgaon curriculum but even semester (II^{nd} semester) was not granted then such student shall be shifted in autonomous curriculum for even semester (II^{nd} semester) of the academic year 2015-16 or onward. He/she shall pass all the courses of odd semester (I^{st} semester) as per NMU, Jalgaon curriculum. In addition; he/she shall register and pass all other courses of autonomous curriculum for which exemption is not granted as per above chart during even semester (II^{nd} semester) or whenever institute offers that subject. **In any case; any student shall not be declared as pass in S.Y.B.Tech.(E&Tc) without obtaining exemption or passing all courses of S.Y.B.Tech. (E&Tc) as per above chart.**

2. If any student who was admitted in second year engineering (E&Tc) before the academic year 2015-16 and failed second year engineering as per NMU, Jalgaon curriculum shall pass all the courses of second year engineering as per NMU, Jalgaon curriculum. Such student shall be eligible to take admission in T. Y. B. Tech. for the academic year 2016-17 or onward if his/her result is pass/ATKT as per NMU, Jalgaon result. In addition; he/she shall register and pass all the courses of S.Y.B.Tech. of autonomous curriculum for which exemption cannot be granted as per above chart; during the academic year of T.Y.B.Tech. or whenever institute offers that course. **To pass all such courses shall be the mandatory condition for the award of degree.**

3. The students who are directly admitted to S.Y. B. Tech. (E&Tc) after diploma in engineering (Electronics discipline) shall register and pass the courses SH 155 General Proficiency and SH 153 Environmental Studies. In addition; any student who is directly admitted to S.Y. B. Tech. (E&Tc) after diploma in engineering (Non Electronics discipline) shall register and pass the courses SH 155 General Proficiency, SH 153 Environmental Studies, ET 101 Basic Electronic

Engineering and ET 102 Basic Electronic Engineering Lab. All such students shall register and pass all above courses during the academic year of S.Y.B.Tech. or whenever institute offers those courses. **To pass all such courses shall be the mandatory condition for the award of degree.**

4. BoS Chairman is authorized to decide equivalency of any other case (not covered above) in consultation with DFB.