

Kazi Nazrul University, Asansol

SYLLABUS OF B.SC. (PROGRAM) WITH ELECTRONICS

2019-2020

SEMESTER – I

Core Course - I (Theory)

Credit 04

CIRCUIT THEORY AND NETWORK ANALYSIS

50 Lectures

Basic Circuit Concepts

Voltage and current sources, Resistors in series and parallel, Inductors, Fixed and variable inductors, Self and mutual inductance, Faraday's law and Lenz's law of electromagnetic induction, Energy stored in an inductor, Capacitors, Principles of capacitance, Parallel plate capacitor, Permittivity, Definition of Dielectric Constant, Dielectric strength, Energy stored in a capacitor.

[10]

DC Transient Analysis

RC Circuit- charging and discharging, Growth and decay of current in RL Circuit, Time Constant, RL and RC Circuits with DC sources, DC Response of Series RLC Circuits.

[10]

AC Circuit Analysis

Sinusoidal Voltage and Current, Definition of Instantaneous, Peak, Peak to Peak, Root Mean Square and Average Values. Voltage-Current relationship in Resistor, Inductor and Capacitor, Phasor diagrams, Complex Impedance, Power in AC Circuits, Instantaneous Power, Average Power, Reactive Power, Power Factor.

Sinusoidal Circuit Analysis for RL, RC and RLC Circuits. Resonance in Series and Parallel RLC Circuits, Frequency Response of Series and Parallel RLC Circuits, Quality (Q) Factor and Bandwidth.

Passive Filters: Low Pass, High Pass, Band Pass and Band Stop.

[15]

Circuit Analysis

Kirchhoff's Current Law (KCL), Kirchhoff's Voltage Law (KVL), Node analysis, Mesh analysis.

[5]

Network Theorems

Principal of Duality, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, T and π types of networks, Image and Characteristic impedances, Maximum Power Transfer Theorem.

Two Port Networks: Impedance (Z) Parameters, Admittance (Y) Parameters.

[10]

Text and References:

**A Text Book on Electrical Technology Vol-1, B. L. Theraja & R. K. Theraja, S. Chand.
Network Analysis, Van Valkenburg, Pearson.**

Electronic Circuits, Schilling and Belove, TMH.

Electric Circuits, S. A. Nasar, Schaum's outline series, Tata McGraw Hill (2004).

Electrical Circuits, M. Nahvi & J. Edminister, Schaum's Outline Series, Tata McGraw-Hill (2005).

Electrical Circuits, K.A. Smith and R.E. Alley, 2014, Cambridge University Press.

Network, Lines and Fields, J.D. Ryder, Prentice Hall of India.

Electrical Circuit Analysis, Mahadevan and Chitra, PHI Learning.

Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn., Oxford University Press.

Core Course - I (Practical) LAB – I

Credit 02

List of Experiments:

1. Familiarization with basic electronic components (R, C, L, diodes, transistors), digital Multimeter, Function Generator and Oscilloscope.
2. Determination of the current through a resistance by potentiometer.
3. Verification of (a) Thevenin's theorem and (b) Norton's theorem.
4. Verification of the Maximum Power Transfer Theorem.
5. Study of response curve of LCR series resonance.
6. Study of I-V characteristics of a suitable resistor and that of a junction diode within specified limit on a graph, and hence to estimate d.c. and a.c. resistances of both the elements at the point of intersection.

Text and References:

Basic Electronics: A Text Lab Manual, Zbar, TMH.

Laboratory Manual for Electronic Devices and Circuits, Bell, PHI.

Laboratory Manual for Electric Circuits, Bell, PHI.

Electric Circuits: Schaum's Outlines, J. Edminister and M. Nahvi, TMH.

Advanced Practical Physics Volume II B. Ghosh, New Central Book Agency.

An Advanced Course in Practical Physics, Chattopadhyay and Rakshit, New Central Book Agency(P) Limited.

SEMESTER – II

Core Course - II (Theory)
SOLID STATE ELECTRONICS

Credit 04
50 Lectures

Semiconductor Physics

The atomic structure, Energy band diagram and classifications of solids, Metals insulators and semiconductors (Qualitative discussions only), Generation of hole-electron pairs at room- temperature and intrinsic semiconductor, Energy band diagram, carrier density; doping and impurity semiconductor, majority and minority carriers, p-type and n-type semiconductors, advantage of silicon over germanium as semiconductor device material, Transport parameters, Current flow in semiconductors, Diffusion and Drift current.

[10]

Junction Diode and its applications

p-n junction and its properties (depletion region, barrier voltage, barrier width, junction capacitance and junction resistance), Junction diode, forward and reverse biased characteristics, diode equation (I-V expression only), a.c. and d.c. resistances of a diode, Zener and avalanche breakdown. Qualitative idea of Schottky diode.

Use of diode as rectifier, calculation of ripple factor and efficiency of half and full wave rectifier, Filter-capacitor and inductance filters, their role in power supply, output waveform and working, Regulation-Line and load regulation, Zener diode as voltage regulator.

[15]

Bipolar Junction Transistor

Bipolar Junction Transistors (NPN & PNP), Principles of operation, Different modes of operations, Input and output characteristics of transistor in CE and CB configurations, Regions of operation (active, cut off and saturation), Current gains α and β , Relations between α and β , dc load line and Q point, Simple problems.

Biasing of BJT (PNP and NPN), idea of bias stability, Factors affecting Stability, Stability factor, Study of Fixed, Self and Voltage divider biasing.

[15]

Unipolar Devices

JFET, Construction, working and I-V characteristics (output and transfer), Pinch off voltage, MOSFET (Enhancement and Depletion) and its characteristics.

UJT, basic construction, working, equivalent circuit and I-V characteristics.

[10]

Reference Books:

Introduction to Solid State Physics, C.Kittel, John Wiley.

Integrated Electronics, Millman and Halkias, TMH.

Foundations of Electronics, Chattopadhyay and Rakshit, New Age.

Basic Electronics -Solid State, B.L. Theraja (Current Edition).

Principles of Electronics, V.K. Mehta (Current Edition).

Electronic Devices and Circuit Theory, R. L. Boylestad and L. Nashelsky, Pearson.

Basic Electronics & Linear Circuits, Bhargava, Kulashretha, Gupta, TMH.

Solid State Electronic Devices, Streetman & Banerjee, PHI.

Electronic Devices and Circuits, Salivahanan, TMH .

Electronic Devices and Circuits, David A. Bell, 5th Edition 2015, Oxford University Press.

Electronic Circuits: Discrete and Integrated, D.L. Schilling and C. Belove, Tata McGraw Hill.

Core Course - II (Practical) LAB – II

Credit 02

Solid State Electronics

List of Experiments:

1. Study of P-N Junction diode characteristics, to calculate dc and ac resistances.
2. Study of Zener diode Characteristics in reverse bias, to determine breakdown voltage and ac resistance at breakdown.
3. Study of Transistor input & output characteristics (CE & CB Modes). To determine dc & ac resistances and current gain.
4. Study of mutual and drain characteristics of JFET, to determine JFET parameters and to verify their interrelation.
5. Study of half & full wave rectifier with junction diode with (capacitor) and without filter.
6. Study of voltage regulation using Zener diode.

Text and References:

Basic Electronics: A Text Lab Manual, Zbar, TMH.

Laboratory Manual for Electronic Devices and Circuits, Bell, PHI.

Laboratory Manual for Electric Circuits , Bell, PHI.

Electric Circuits: Schaum's Outlines, J. Edminister and M. Nahvi, TMH.

Advanced Practical Physics Volume II B. Ghosh, New Central Book Agency.

An Advanced Course in Practical Physics, Chattopadhyay and Rakshit, New Central Book Agency(P) Limited.

SEMESTER – III

Core course – VII - ELECTRONIC COMMUNICATION (Credit -06)

(Credits: Theory-06)

Theory: 50 Lectures

Radio Wave Propagation

(10)

Characteristics of electromagnetic wave, propagation of radio waves in different frequencies, structure of the atmosphere, ground wave propagation, sky wave, critical frequency and virtual height, maximum usable frequency and skip distance(qualitative discussions only).

Electronic communication

(10)

Introduction to communication – means and modes. Need for modulation. Block diagram of an electronic communication system. Brief idea of frequency allocation for radio communication system in India (TRAI).Electromagnetic communication spectrum, band designations and usage.Channels and base-band signals.Concept of Noise, signal-to-noise (S/N) ratio.

Analog Modulation

(20)

Amplitude Modulation, modulation index and frequency spectrum.Generation of AM (Emitter Modulation), Amplitude Demodulation (diode detector), Concept of Single side band generation and detection. Frequency Modulation (FM) and Phase Modulation (PM), modulation index and frequency spectrum, equivalence between FM and PM

Generation of FM using VCO, FM detector (slope detector), Qualitative idea of Super heterodyne receiver.

Satellite Communication

(10)

Introduction, need, Geosynchronous satellite orbits, geostationary satellite, advantages of geostationary satellites. Satellite visibility, transponders (C - Band), path loss, ground station, simplified block diagram of earth station. Uplink and downlink.

SKILL ENHANCEMENT COURSE

SEC - 1

(Credit: 2)

Design and Fabrication of electronic circuits

1. Knowledge of electronic/electrical components, resistor, capacitor, inductor, transformer, signal sources (ac and dc), transistor, FETs, op-amps.
2. Design of CE AF amplifier on broadband, design of Zener Diode regulator, FET audio amplifier, feedback amplifier, design of low frequency oscillator, various Op-Amp circuits, modulator and demodulator.

Construction of radio receiver, square wave generator.

References:

Basic Electronics: A Text Lab Manual, Zbar, TMH

Laboratory Manual for Electronic Devices and Circuits, Bell, PHI Laboratory Manual for Electric Circuits , Bell, PHI

Electric Circuits: Schaum's Outlines, J. Edminister and M. Nahvi, TMH

SEMESTER – IV

Core course – X Analog Electronics (Theory, Credit - 4)

(Theory)

Theory: 50 Lectures

Feed back in Amplifier: General theory of feedback, negative and positive feedback, advantages of negative feedback, types of negative feedback in transistor amplifiers, current series, voltage series, current shunt – voltage amplifier (qualitative discussion only).

(20)

Voltage and Power amplifiers: Class A, B, C and AB amplifiers, Class-B Push pull amplifier, RC coupled, Transformer coupled amplifiers (qualitative discussion only).

(10)

Oscillators: Positive feedback and oscillation, Barkhausen Principle, Collector Tuned Oscillator, Phase shift oscillator, Crystal Oscillator. (qualitative discussion only), basic idea of Multivibrators,

(10)

Operational Amplifier: Differential Amplifier, CMRR, Characteristics of ideal OPamp, Inverting & noninverting amplifier, Adder, Integrator and Differentiator circuits using Op Amp.

(10)

References :

Integrated Electronics, Millman and Halkias, TMH.

Electronic Principles, Malvino, TMH .

OP-Amp and Linear Integrated circuits, Gaykwad, Pearson.

Foundations of Electronics ,Chattopadhyay and Rakshit New Age International.

Analog Electronics : Devices and Circuits , B.C. Sarkar and S. Sarkar, Damodar Group, Burdwan.

Electronics, V.K.Mehta

Basic Electronics, B.L.Theraja

Electronics, B.Ghosh

Core course – X (Practical)

Analog Electronics, DSC - ID Lab –III (Credit : 2)

1. To draw the static characteristics of P-N-P and N-P-N transistors in CB, CE, modes.
2. To study JFET characteristics
3. To study transistor CE amplifier.
4. To study Op AMP inverting amplifier.
5. To study adder using Op AMP.

References:

Basic Electronics: A Text Lab Manual, Zbar, TMH

Laboratory Manual for Electronic Devices and Circuits, Bell, PHI Laboratory Manual for Electric Circuits , Bell, PHI

Electric Circuits: Schaum's Outlines, J. Edminister and M. Nahvi, TMH. Practical Physics ,Rakshit and Chattopadhyay

Advanced Practical Physics Volume II B. Ghosh, New Central Book Agency.

SKILL ENHANCEMENT COURSE

SEC - 2

(Credit: 2)

Household wiring and repairing of domestic appliances

1. Concept of house wiring, use of fuses, protection devices, etc, choice of wires depending on the current consumption, parallel connections, knowledge of LEDs, CFLs, use of heat-sinks, calculation of loads.
2. Repairing and servicing of refrigerator, μ wave oven, induction heater, gas stoves, geyser, battery maintenance and repairing of charging devices, coil winding of fans, grinder-mixer repairing.

SEMESTER – V

SKILL ENHANCEMENT COURSE

SEC - 3

(Credit: 2)

ELECTRONICS : DIGITAL CIRCUIT

- 1) Design and study of clock frequency generator.
- 2) Study of R-S flip-flop.
- 3) Study of decade counter.
- 4) Study of Master-Slave flip-flop.

DISCIPLINE SPECIFIC ELECTIVES (DSE)

DSE- IA: Theory

Credit – 4

(Any one from A & B)

A) DIGITAL ELECTRONICS (Credit 4) 50 lectures

Number Systems: Decimal numbers, binary number, octal numbers, hexadecimal numbers, BCD numbers (weighted and unweighted codes), Excess three code,

Gray code, parity conversions, arithmetic operations, ASCII, Extended ASCII codes, 9's and 10's complement code. (8)

Boolean algebra: Boolean relations, commutative, associative and distributive

laws, OR, AND, and NOT operations, De Morgan theorems. (5)

Logic Gates: Inverters, OR, AND and NOR gates, EX-OR and EX-NOR gates, Simplification of Boolean expressions using Boolean algebra and De-Morgan's theorems, sum of products and product of sums forms, Karnaugh-map, NAND and

NOR gates as universal building blocks. (15)

Combinational Logic: Binary adder, half adder, full adder, Multiplexer

and Demultiplexer. (10)

Sequential Circuits: Latches, Flip-flops, R-S flip-flop, J-K flip-flop, Master -slave

flip-flop, D flip-flop, T flip-flop. (12)

References :

Digital Logic and Computer Design, Mano , Pearson.

Digital computer electronics, Malvino and Brown, Tata McGraw Hill.

Digital Principles, Leach and Malvino , TMH.

Modern Digital Electronics, Jain, TMH.

Digital Circuits, Vol-I and II, D.RoyChaudhuri, Platinum publishers .

A text book of digital electronics, Sedha, S. Chand.

DIGITAL ELECTRONICS DSE-IA (Practical), Lab. (Credit : 2)

Study of basic logic gates.

Study of universal logic gates.

Simplification of SOP and POS circuits.

Study of Karnaugh map.

B) OPTICAL COMMUNICATION

50 lectures

Optoelectronics :Characteristics of optical emission, electro-luminescence. LED:Power and efficiency calculation, Structure of LED and its characteristics, Hetero-junction LED, Photo diode: PIN photodiode, hetero junction diode, Avalanche Photo diode, Phototransistor. LDR, photovoltaic cells, photo emissive cells - types, materials, construction, response, opto-couplers – characteristics, noise figures,

applications in analogue and digital devices.

(30)

Fiber optics: Optical fibre–materials, construction, step index and graded index fibres, ray propagation,attenuation. Modes in optical fibres, intermodal dispersion, single mode fibre- working principle, attenuation, dispersion and bandwidth. Multimode fibre- attenuation, dispersion. Propagation of EM waves,

Fibre coupling.

(20)

References :

Semiconductor Opto Electronics Devices, P. Bhattacharya .

Optoelectronics and Fiber Optic Communication, D C Sarkar and C K Sarkar, New Age.

Photonics : A Yariv and P Yeh. Oxford.

Optical Electronics : By Ghatak and Thyagrajan , Cambridge University Press.

OPTICAL COMMUNICATION DSE-IA (Practical), Lab. (Credit : 2)

- 1) Study of Laser diode and Single mode optical fibre:- Measurement of Power, Frequency & attenuation, and Numerical aperture.

SEMESTER – VI

SKILL ENHANCEMENT COURSE

SEC - 4

(Credit: 2)

ELECTRONICS

- 1) Design and study of DC positive & negative power supplies using ICs.**

DISCIPLINE SPECIFIC ELECTIVES (DSE)

DSE- IB:

Credit – 6

(Any one from A & B)

A) RADIO AND TELEVISION

Credit – 6

50 lectures

Radio Communications: Introduction, basic requirements of radio communications, communication systems, basic features of communication: transmitter, receiver, classification of radio waves, ordinary receiver and super heterodyne receiver. (20)

Radio wave propagation: Introduction, electromagnetic or radio waves, freespace propagation, modes of propagation, ground wave and surface wave, sky wave or ionospheric wave, space wave propagation, tropospheric scatter propagation, sky wave propagation, maximum usable frequency, skip distance

duct propagation.

(20)

Television: Introduction–Historical development, television broadcasting, coverage of television, Basic television system and scanning principles, Essentials

of colour television.

(10)

References:

Antenna and wave propagation, K D Prasad, Satya Prakashan

Electromagnetic field theory, K A Gangadhar, P M Ramanathan, Khanna Publication.

Electromagnetic field theory, S P Ghosh, McGraw Hill.

Principles of electromagnetics, M.N.O. Sadiku, Oxford.

Monochrome and colour television, R.R. Gulati, New Age International.

Television and video engineering, A M Dhake, Tata McGraw Hill.

Colour television, principles and practice, R R Gulati, New Age International.

Electronic (classical and modern), R K Kar, Books & Allied (P) Ltd.

B) MEASUREMENTS and INSTRUMENTATION (Credit - 4)

50 lectures

Basic Measurement Instruments: PMMC instrument, galvanometer, DC measurement - ammeter, voltmeter, ohm meter, AC measurement. (10)

Connectors and Probes: Low capacitance probes, high voltage probes, current probes, identifying electronic connectors – audio and video, RF/Coaxial, USB etc.

(basic idea only).

(5)

AC Bridges: Wheatstone bridge method, A.C. bridges, Measurement of Self Inductance, Maxwell's bridge, Measurement of Capacitance, Schering's bridge, Measurement of frequency, Wien's bridge (qualitative discussion only). (10)

Oscilloscopes: CRT, wave form display and electrostatic focusing, time base and sweep synchronization, measurement of voltage, frequency and phase by CRO.

(10)

Transducers and Sensors: Classification of transducers, Basic requirement/characteristics of transducers, active & passive transducers, Resistive (Potentiometer, Strain gauge – Theory, types, temperature compensation and applications), Capacitive, Inductive (LVDT) and piezoelectric transducers. Measurement of temperature, Optical transducers (photoresistors, photovoltaic

cells, photodiodes).

(15)

References :

Modern Electronic Instrumentation and Measurement Techniques, Helfrick and Cooper, Prentice-Hall of India, Reprint 1988.

Instrumentation Measurement and Feedback, Jones, B.E., Tata McGraw-Hill, 1986.

Electrical Measurement and Measuring Instruments, Golding, E.W., 3rd Edition, Sir Issac Pitman and Sons, 1960.

Measurement Systems: Application and Design, Doebelin E.O. , McGraw Hill Book - Fifth Edition (2003).

Principles of Electrical Measurements, Buckingham, H. and Price, E.N., 1961. Test and measuring instruments

Electronic Instrumentation, Kalsi, Tata McGraw Hill (2006)

A Course on Electrical and Electronic Measurements and Instrumentations, A K Sawhney, Dhanpat Rai & Sons.

DISCIPLINE SPECIFIC ELECTIVES (DSE) : Lab

DSE- IB:

Credit – 2

Measurement of signal characteristics by oscilloscope. Use of sensors / transducers for measurement of pressure, temperature, photo-resistors, and strain.