SEMESTER I & II

B. SC. PHYSICAL SCIENCES

(ELECTRONICS)

CEL- 104
Core Course-I
NETWORK ANALYSIS AND ELECTRONIC DEVICES
(Credits: 02;30 Hrs (2Hrs /week))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I **(8 Hours)**

Circuit Analysis:

Concept of Voltage and Current Sources. Kirchhoff's Current Law, Kirchhoff's Voltage Law. Mesh Analysis. Node Analysis.

UNIT-II **(8 Hours)**

Networks:

Star and Delta networks, Star-Delta Conversion. Principal of Duality. Superposition Theorem. Thevenin Theorem. Norton's Theorem.

UNIT-III **(8 Hours)**

Networks:

Reciprocity Theorem. Maximum Power Transfer Theorem. Two Port Networks: h, y and z parameters and their conversion.

UNIT-IV **(6 Hours)**

Unipolar Devices:

JFET. Construction, working and I-V characteristics (output and transfer), Pinchoff voltage. UJT, basic construction, working, equivalent circuit and I-V characteristics.

Reference Books:

- 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
- Network Analysis, G.K. Mithal, Khanna Publication
- Basic Electronics and Linear Circuits, N.N Bhargava, D C Kulshreshtha
- 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
- Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn.,Oxford University Press.
- J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
- J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw Hill (1991)

CEL- 105
Core Course-II
ANALOG ELECTRONICS
(Credits: 02, 30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I (8 Hours)

Junction Diode:

PN junction diode (Ideal and practical)-constructions, Formation of Depletion Layer, Diode Equation and I-V characteristics.Idea of static and dynamic resistance, dc load line analysis, Quiescent (Q) point. Zener diode, Reverse saturation current, Zener and avalanche breakdown. Qualitative idea of Schottky diode.

Junction Diode Applications:

Rectifiers- Half wave rectifier, Full wave rectifiers (center tapped and bridge), circuit diagrams, working and waveforms, ripple factor and efficiency. Filter-Shunt capacitor filter, its role in power supply, output waveform, and working. Regulation- Line and load regulation, Zener diode as voltage regulator, and explanation for load and line regulation.

UNIT-II (8 Hours)

Bipolar Junction Transistor:

Review of the 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. Transistor biasing and Stabilization circuits- Fixed Bias and Voltage Divider Bias. Thermal runaway, stability and stability factor S.

UNIT-III (7 Hours)

Amplifiers:

Transistor as a two port network, h-parameter equivalent circuit. Small signal analysis of single stage CE amplifier. Input and Output impedance, Current and Voltage gains. Class A, B and C Amplifiers.

Cascaded Amplifiers:

Two stage RC Coupled Amplifier and its Frequency Response.

UNIT-IV (7 Hours)

Feedback in Amplifiers:

Concept of feedback, negative and positive feedback, advantages of negative feedback

Sinusoidal Oscillators:

Barkhausen criterion for sustained oscillations. Phase shift and Colpitt's oscillator. Determination of Frequency and Condition of oscillation.

Reference Books:

- Electronic Devices and Circuits, David A. Bell, 5th Edition 2015, Oxford University Press.
- Basic Electronics and Linear Circuits, N.N Bhargava, D C Kulshreshtha
- Electronic Circuits: Discrete and Integrated, D.L. Schilling and C. Belove, Tata McGraw Hill
- Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn.,Oxford University Press.
- J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
- J. J. Cathey, 2000 Solved Problems in Electronics, Schaum's outline Series, Tata McGraw Hill (1991)

CEP- 109
Practical -I; NETWORK ANALYSIS AND ANALOG ELECTRONICS LAB (Credits: 02, 60 Hours (4hrs. per week))

Marks: 50

Time: 4 Hours

AT LEAST 12 EXPERIMENTS FROM THE FOLLOWING BESIDES #1

6. To familiarize with basic electronic components (R, C, L, diodes, transistors), digital Multimeter, Function Generator and Oscilloscope.
7. Measurement of Amplitude, Frequency & Phase difference using Oscilloscope.
8. Verification of (a) Thevenin's theorem and (b) Norton's theorem.
9. Verification of (a) Superposition Theorem and (b) Reciprocity Theorem.
10. Verification of the Maximum Power Transfer Theorem.
11. Study of the I-V Characteristics of (a) p-n junction Diode, and (b) Zener diode.
12. Study of (a) Half wave rectifier and (b) Full wave rectifier (FWR).
13. Study the effect of (a) C- filter and (b) Zener regulator on the output of FWR.
14. Study of the I-V Characteristics of UJT and design relaxation oscillator..
15. Study of the output and transfer I-V characteristics of common source JFET.
16. Study of Fixed Bias and Voltage divider bias configuration for CE transistor.
17. Design of a Single Stage CE amplifier of given gain.
18. Study of the RC Phase Shift Oscillator.
19. Study the Colpitt`s oscillator.

Reference Books:

- Networks, Lines and Fields, J.D.Ryder, Prentice Hall of India.
- J. Millman and C. C. Halkias, Integrated Electronics, Tata McGraw Hill (2001)
- Electrical Circuits, M. Nahvi and J. Edminister, Schaum's Outline Series, Tata McGraw-Hill (2005)
- Allen Mottershead, Electronic Devices & Circuits, Goodyear Publishing Corp oration.

CEL 204
Core Course-III
LINEAR AND DIGITAL INTEGRATED CIRCUITS
(Credits: 02; 30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all . Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I

Operational Amplifiers (Black box approach): **(8 Hours)**

Power supplies for ICs, Interpretation of data sheets, Characteristics of an Ideal and Practical Operational Amplifier (IC 741), Ideal voltage transfer curve, Open and closed loop configuration, Frequency Response. CMRR. Slew Rate and concept of Virtual Ground.

UNIT-II

Applications of Op-Amps: **(8 Hours)**

(1) Inverting and non-inverting amplifiers, (2) Summing and Difference Amplifier (3) Differentiator, (4) Integrator (5) Voltage to current converter

UNIT-III

Applications of Op-Amps: **(8 Hours)**

(6) Active low pass and high pass Butterworth filter (1st and 2nd order) (7) Wein bridge oscillator (8) Square wave generator(9) Comparator and Zero-crossing detector (10) clippers and clampers

UNIT-IV

D-A and A-D Conversion: **(6 Hours)**

4 bit binary weighted and R-2R D-A converters, circuit and working. Accuracy and Resolution. A-D conversion characteristics, successive approximation ADC. (Mention of relevant ICs for all).

Reference Books:

- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall
- Operational Amplifiers and Linear ICs, David A. Bell, 3rd Edition, 2011, Oxford University Press.
- Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011,Tata McGraw
- Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.

CEL 205
Core Course-IV
DIGITAL ELECTRONICS
(Credits: 02; 30 Hrs (2Hrs /week)))

Marks for Major Test (External): 80
Marks for Internal Exam: 20
Time: 3 Hours

Paper setter is required to set nine questions in all. Question no. 1 is Compulsory and is based on the entire syllabus consisting of eight to ten short answer type questions each of 2 marks. The remaining eight questions is to be set uniformly having two questions from each unit. The student is required to attempt five questions in all selecting one question from each unit and Question no. 1 is Compulsory wherein student is required to attempt 8 parts.

UNIT-I **(8 Hours)**

Number System and Codes:

Decimal, Binary, Octal and Hexadecimal number systems, base conversions.

Representation of signed and unsigned numbers, BCD code. Binary, octal and hexadecimal arithmetic; addition, subtraction by 2's complement method, multiplication. **Logic Gates and Boolean algebra**:

Truth Tables of OR, AND, NOT, NOR, NAND,XOR, XNOR, Universal Gates, Basic postulates and fundamental theorems of Boolean algebra.

UNIT-II **(8 Hours)**

Combinational Logic Analysis and Design:

Standard representation of logic functions(SOP and POS), Minimization Techniques (Karnaugh map minimization up to 4 variables for SOP). **Arithmetic Circuits**:

Binary Addition. Half and Full Adder. Half and Full Subtractor, 4-bit binary Adder/ Subtractor.

Data processing circuits:

Multiplexers, De-multiplexers, Decoders, Encoders.

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UNIT-III **(8 Hours)**

Clock and Timer (IC 555):

Introduction, Block diagram of IC 555, Astable and Monostable multivibrator circuits

Sequential Circuits:

SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. Master-slave JK Flip-Flop.

UNIT-IV **(6 Hours)**

Shift registers:

Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).

Counters (4 bits):

Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter.

Reference Books:

- Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011,Tata McGraw
- Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
- Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
- Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHI Learning.
- Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
- R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw-Hill (1994)

CEP 209

Practical -II; LINEAR INTEGRATED CIRCUITS AND DIGITAL ELECTRONICS LAB

(Credits: 02; 60 Hrs (4Hrs /week)

Marks: 50

Time: 4 Hours

At least 04 experiments each from section A, B and C

Section-A: Op-Amp. Circuits (Hardware)

1. To design an inverting amplifier using Op-amp (741,351)for dc voltage of given gain
2. (a) To design inverting amplifier using Op-amp (741,351) & study its frequency response

   (b) To design non-inverting amplifier using Op-amp (741,351) & study frequency response
3. (a) To add two dc voltages using Op-amp in inverting and non-inverting mode

   (b) To study the zero-crossing detector and comparator.
4. To design a precision Differential amplifier of given I/O specification using Op-amp.
5. To investigate the use of an op-amp as an Integrator.
6. To investigate the use of an op-amp as a Differentiator.
7. To design a Wien bridge oscillator for given frequency using an op-amp.
8. To design a circuit to simulate the solution of simultaneous equation and 1st/2ndorder differential equation.
9. Design a Butterworth Low Pass active Filter (1st order) & study Frequency Response
10. Design a Butterworth High Pass active Filter (1st order) & study Frequency Response
11. Design a digital to analog converter (DAC) of given specifications.

Section-B: Digital circuits (Hardware)

1. (a) To design a combinational logic system for a specified Truth Table.

   (b) To convert Boolean expression into logic circuit & design it using logic gate ICs.

   (c) To minimize a given logic circuit.

2. Half Adder and Full Adder.

3. Half Subtractor and Full Subtractor.

4. 4 bit binary adder and adder-subtractor using Full adder IC.

5. To design a seven segment decoder.

6. To design an Astable Multivibrator of given specification using IC 555 Timer.

7. To design a Monostable Multivibrator of given specification using IC 555 Timer.

8. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.

9. To build JK Master-slave flip-flop using Flip-Flop ICs

10. To build a Counter using D-type/JK Flip-Flop ICs and study timing diagram.

11. To make a Shift Register (serial-in and serial-out) using D-type/JK Flip-Flop ICs.

Section-C: SPICE/MULTISIM simulations for electronic circuits and devices

1. To verify the Thevenin and Norton Theorems.
2. Design and analyze the series and parallel LCR circuits
3. Design the inverting and non-inverting amplifier using an Op-Amp of given gain
4. Design and Verification of op-amp as integrator and differentiator
5. Design the 1storder active low pass and high pass filters of given cutoff frequency
6. Design a Wein`s Bridge oscillator of given frequency.
7. Design clocked SR and JK Flip-Flop`s using NAND Gates
8. Design 4-bit asynchronous counter using Flip-Flop ICs
9. Design the CE amplifier of a given gain and its frequency response.

Reference Books :

- Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed., 2011,Tata McGraw
- OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edn., 2000, Prentice Hall
- R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw-Hill (1994)
- Digital Electronics, S.K. Mandal, 2010, 1st edition, McGraw Hill