ADVANCED ELECTRONICS
EX 601

Lecture : 3 **Year : III**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objectives:

To provide knowledge on data conversion, amplifiers, instrumentation and power circuits

1. Operational Amplifier Circuits **(6 hours)**

1.1 Bias circuits suitable for IC Design
1.2 The Widlar current source
1.3 The differential amplifier
1.4 Active loads
1.5 Output stages

2. Operational Amplifier Characterization **(8 hours)**

2.1 Input offset voltage
2.2 Input bias and input offset currents
2.3 Output impedance
2.4 Differential and common-mode input impedance
2.5 DC gain, bandwidth, gain-bandwidth product
2.6 Common-mode and power supply rejection ratios
2.7 Higher frequency poles settling time
2.8 Slew rate
2.9 Noise in operational amplifier circuits

3. Digital-To-Analog and Analog-To-Digital Conversion **(8 hours)**

3.1 The R-2R ladder circuit
3.2 Unipolar and bipolar D/A converters
3.3 Count-up and Tracking A/D's based on D/A's
3.4 Successive approximation A/D converters
3.5 Integrating voltage-to-time conversion A/D converters, dual and quad slope types
3.6 Sigma delta A/D converters
3.7 Flash A/D converters

4. Instrumentation and Isolation Amplifiers **(4 hours)**

4.1. One and two operational amplifier instrumentation amplifiers
4.2. The three operational amplifier instrumentation amplifier
4.3. Consideration of non-ideal properties
4.4. Isolation amplifier principles and realization
4.5. Consideration of non-ideal properties

5. Operational Amplifier-Bipolar Transistor Logarithmic Amplifier (3 hours)

5.1 The basic logarithmic amplifier
5.2 Non-ideal effects
5.3 Stability consideration
5.4 Anti-logarithmic operations

6. Log-Antilog Circuit Application (5 hours)

6.1 Analog multiplier based on log-antilog principles
6.2 The multifunction converter circuit
6.3 Proportional to absolute temperature (PTAT) devices
6.4 RMS to dc conversion

7. Introduction to Power Electronics (7 hours)

7.1 Diodes, thyristors, triacs, IGBT
7.2 Controlled rectifier circuits
7.3 Inverters
7.4 Choppers
7.5 DC-to-DC conversion
7.6 AC-to-AC conversion

8. Switched Power Supplies (4 hours)

8.1 Voltage step-down regulators
8.2 Voltage step-up regulators
8.3 Step-up/step-down regulators
8.4 Filtering considerations
8.5 Control circuits, IC switched

Practical:

1. Characteristics of operational amplifier
2. 4 bit D to A converter
3. Differential amplifier, Instrumentation amplifier
4. Logarithmic amplifier
5. Study of switched voltage regulator
6. Study of Silicon-controlled-rectifier (SCR) and TRIAC circuit

Reference:

1. A.S. Sedra and K.C. Smith, "Microelectronic Circuits", Oxford University Press.
2. W. Stanely, "Operational Amplifiers with Linear Integrated Circuits", Charles E. Merrill Publishing Company, Toronto.
3. Jacob Millman and Christos C. Halkias, "Integrated Electronics", TATA McGRAW- Hill Edition.
4. Muhammad H. Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson Education.

5. Ramakant A. Gayakwad, "Operational Amplifiers with Linear Integrated Circuits", Prentice Hall, New Delhi.
6. Robert F. Coughlin and Frederick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Prentice Hall, New Delhi.
7. C.W. Lander, "Power Electronics", McGraw-Hill Book Company, New York.
8. J.G. Graeme, "Application of Operational Amplifiers: Third Generation Techniques", The Burr-Brown Electronics Series, McGraw-Hill, New York.
9. N. Mohan, T. M. Undeland and W. P, Robbins, "Power Electronics: Converters, Applications and Design", John Willey and Sons, New York.