Course Name: Analog Electronic Circuits
Course Code: EC (EE) 301
Credit: 3

Prerequisites:

Sl. No.	Subject	Description	Level of Study
01	Circuit Theory	Kirchoff current law,Kirchhof voltage law,Two port network	Class XII, 3rd Sem
02	Basic Electronics	Semiconductor device	1st Sem, 2nd Sem

Course Objective:

- To expose the students semiconductor device, performance characteristics and their application.
- To expose different signal processing technique and characteristics

Course Outcomes:

At the end of the course, a student will be able to:

1. **Illustrate** working principle of different electronic circuit and their application in real life.
2. **Define** semiconductor device and different operating condition and their performance parameter.
3. **Choose** proper semiconductor devices depending upon application considering economic and technology up-gradation.
4. **Employ** mathematical and graphical **analysis** considering different practical issues modeling of semiconductor device; **analyze** the performance parameter of the system.
5. **Recognize** different signal processing circuit and the **use** in industrial, real life, modern control system application.
6. **Use** modeling/simulation parameters with standard equivalent circuit models to **predict** correctly the expected performance of various general-purpose electronic circuits.

CO- PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	3	2	3	2	3	-	3	-	-	-	-
2	1	1	3	3	3	1	3	3	1	3	-	1
3	2	3	3	2	1	3	3	-	1	-	1	-
4	3	2	2	3	3	3	-	3	2	-	-	3
5	3	2	3	2	3	2	-	3	3	3	1	3
6	3	2	2	1	1	3	2	2	-	1	1	-

Correlation levels 1, 2 or 3 as defined above: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) and "-" if there is no correlation.

Syllabus Indicating CO:

Module no	Content	Relevant CO's
1	**Filters & Regulators,** Capacitor filters, pi-section filter, ripple factor series and shunt voltage regulator, percentage regulation Concept of SMPS.	**CO 1, CO 2** **CO 3, CO 4** **CO 5 ,CO 6**
2	**Transistor biasing & stability:** Q point, Self Bias-CE, Compensation techniques, h-model of Transistor Expression of voltage gain, current gain, input & output impedance, Trans-resistance & Trans-conductance Emitter follower circuits, High Frequency model of Transistor.	**CO 1, CO 2** **CO 3, CO 4** **CO 5 ,CO 6**
3	**Transistor amplifier:** RC coupled amplifier, Function of all components, Equivalent circuit, derivation of voltage gain, Current gain, Input impedance & output impedance Frequency response characteristics, Lower & upper half frequencies, Bandwidth Concept of Wide band amplifier.	**CO 1, CO 2** **CO 3, CO 4** **CO 5 ,CO 6**
4	**Feed back amplifier & Oscillators:** Concept of Feed back, Negative & Positive feedback, Berkhausen criterion,Voltage/Current, Series/Shunt feedback,Colpit ,Hartley's, Phase shift,Wien bridge, & Crystal oscillators.	**CO 1, CO 2** **CO 3, CO 4** **CO 5 ,CO 6**
5	**Operational amplifier:** Ideal OPAMP, Differential amplifier, Constant current source (Current mirror etc), Level shifter, CMRR, Open & closed loop circuits, importance of feedback loop (positive & negative), inverting & non-inverting amplifiers,	**CO 1, CO 2** **CO 3, CO 4** **CO 5 ,CO 6**

	Voltage follower/Buffer circuits.	
6	**Application of Operational amplifiers:** Adder, Integrator & Differentiator, , Comparator, Schmitt Trigger, Instrumentation Amplifier, Log & Antilog amplifier Trans-conductance multiplier, Precision rectifier, Voltage to current & Current to voltage converter.	**CO 1, CO 2** **CO 3, CO 4** **CO 5 ,CO 6**
7	**Power amplifier:** Class A, B, AB, C, Conversion efficiency, Tuned amplifier.	CO 1, CO 2 CO 3, CO 4 CO 5 ,CO 6
8	**Multivibrator:** Monostable, Bistable multivibrator, Monostable & Astable Operation using 555 timers.	CO 1, CO 2 CO 3, CO 4 CO 5 ,CO 6
9	**Special function circuits:** VCO & PLL	CO 1, CO 2 CO 3, CO 4 CO 5 ,CO 6

Gap Analysis

S. No.	Gap	Action taken	Relevance to POs, PSOs
1	**Modeling of semiconductor device:** This is very useful to design electronic circuit for performances estimation, but missing in the syllabus. **Topics covered:** Diode, Transistor, and MOSFET modeling using PSPICE Software.	The PSPICE workshop is arranged, **lecture classes, providing notes, and by solving numerical problems.**	**PO 1, PO 2,PO3** **PO7, PO8**
2	**Application of 555 Timer:** This topic is very much relevant for manufacturing industries, but missing in the syllabus. **Topics covered:** Gate Pulse generation for control Switch.	Additional **lecture classes** are organized to cover the topics.	**PO 1, PO 2,PO3** **PO7, PO8**
3	**Optical Isolation using semiconductor device:** This is an very important topic for isolating power circuit and control circuit, but missing in the syllabus. **Topics covered:** Photo Diode ,Photo transistor etc	These are emergent topics and therefore are covered in continuation with **lectures and providing research papers**.	**PO 1, PO 2,PO3** **PO7, PO8**
4	**Different type of Filters :** This is an very important topic for Cancelling the unwanted signal, but missing in the syllabus.	Additional **lecture classes** are organized and **practical problems are given** (in the workshop) for better understanding and developing	**PO 1, PO 2,PO3**

	Topics covered: Butter worth filter ,Band Pass Filter and Band Stop Filter	the real-life problem solving ability.	**PO8**
5	**Transformer Based Amplifier:** This is an important topic but missing in syllabus **Topics covered:** Class A ,B AB etc push pull amplifier	Additional **lecture classes** are organized and **practical problems are given** (in the workshop) for better understanding and developing the real-life problem solving ability.	**PO 1, PO 2** **PO7, PO8**
6	**Different types of signal Generation:** This is an important topic but missing in syllabus **Topics Covered:** sample and hold circuit, triangle wave ,saw tooth gen	Additional **lecture classes** are organized to cover the topics.	**PO 1, PO 2,PO3** **PO7, PO8**

Lecture Plan:

Cl. No.	Date	Topics	Remarks
1		**Filters & Regulators,** Capacitor filters, □-section filter, ripple factor	
2 & 3		series and shunt voltage regulator, percentage regulation	
4		Concept of SMPS.	
5		**Transistor biasing & stability:** Q point, Self Bias-CE, Compensation techniques,	

6		h-model of Transistor	
7 & 8		Expression of voltage gain, current gain, input & output impedance, Trans-resistance & Trans-conductance	
9		Emitter follower circuits, High Frequency model of Transistor.	
10		**Transistor amplifier:** RC coupled amplifier, Function of all components,	
11		Equivalent circuit, derivation of voltage gain, Current gain, Input impedance & output impedance	
12 &13		Frequency response characteristics, Lower & upper half frequencies, Bandwidth	
14		Concept of Wide band amplifier.	
15		**Feed back amplifier & Oscillators:** Concept of Feed back, Negative & Positive feedback,	
16		Berkhausen criterion,Voltage/Current, Series/Shunt feedback	
17		Colpit , Hartley's, Phase shift,	
18		Wien bridge, & Crystal oscillators.	
19		**Operational amplifier:** Ideal OPAMP, Differential amplifier,	
20		Constant current source (Current mirror etc), Level shifter, CMRR, Open & closed loop circuits,	
21 &22		importance of feedback loop (positive & negative), inverting & non-inverting amplifiers,	
23		Voltage follower/Buffer circuits.	
24		**Application of Operational amplifiers:** Adder, Integrator & Differentiator, ,	

25		Comparator, Schmitt Trigger, Instrumentation Amplifier, Log & Antilog amplifier	
26		Trans-conductance multiplier, Precision rectifier,	
27		Voltage to current & Current to voltage converter.	
28 & 29		**Power amplifier:** Class A, B, AB, C,	
30 & 31		Conversion efficiency, Tuned amplifier.	
32 & 33		**Multivibrator:** Monostable, Bistable multivibrator, Monostable & Astable Operation using 555 timers.	
34 & 35		**Special function circuits:** VCO & PLL	

Recommended Books:

1. Microelectronic Circuits, Sedra & Smith, Oxford University Press.
2. Integrated Electronics, Milman & Halkias, Mc Graw Hill Company.
3. Electronic devices & Circuits, Balbir Kumar & Shail B. Jain, PHI.
4. Op-amps and Linear IC's, R.A. Gayakwad, PHI.
5. Microelectronic Circuit- Analysis & Design, Rashid, Cenage Learning.
6. Electronic Circuits: Discrete & Integrated, 3rd Edition, Schilling & Belove, Mc Graw Hill Company.
7. Electronic principles, 6th Edition, Malvino, Mc Graw Hill Company.
8. Operational Amplifier & Linear IC's, Bell, Oxford University Press.
9. 2000 Solved Problems in Electronics, Jimmie J. Cathey, Mc Graw Hill Inc.
10. Electronic Devices -System & Application, Robert Diffenderfer, Cengage Learning.
11. Op- Amps & Linear Integrated Circuits, Ravi Raj Dudeja & Mohan Dudeja, Umesh Publication.