Kadi Sarva Vishvavidyalaya, Gandhinagar
Bachelor of Engineering (Electrical Engineering Syllabus)

ELECTRONICS DEVICES & CIRCUITS
B.E. SEM – III
SUB. CODE: EE 305

A. **Cource Objective:**

- To present application oriented approach to the students in the field of electronic circuits.

B. **Teaching / Examination Scheme**

SUBJECT		Teaching Scheme				Total Credit	Examination Scheme					Total Marks
CODE	NAME	L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
		Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
EE-305	Electronics Devices& Circuits	4	0	2	6	5	03	70	30	20	30	150

C. **Detailed Syllabus**

1. **Semiconductor Diodes**
   Introduction, Semiconductor materials, covalent bond and intrinsic materials, energy levels, extrinsic materials: p-type and n-type semiconductors, semiconductor diodes, ideal versus practical diodes, resistance levels, diode equivalent circuits, transition and diffusion capacitance, reverse recovery time, diode specification sheet, zener diode, Light Emitting diode, Tunnel diode, schottky diode, varicap diode
2. **Diode Circuits**
   Introduction, Load –line Analysis, Series Diode configuration, Parallel and series-parallel configurations, Typical diode circuits, Half-wave & Full wave rectifier, Clippers, Clampers, Zener Diode as voltage regulators, Voltage multiplier circuits, Practical Applications of diode circuits
3. **Bipolar Junction Transistor**
   Introduction, Transistor construction, Operation, Common-base configuration & characteristic, Transistor Amplifying action, Common-Emitter configuration & characteristic, Common-collector configuration & characteristic, Limits of operation, study of Transistor data sheet
4. **DC-biasing of Bipolar Junction Transistors**
   Introduction, operating point, Fixed biased configuration, Emitter-bias configuration, Voltage divider bias configuration, collector feedback configuration, Emitter follower configuration, Miscellaneous configuration, Design operations, current mirror circuits, current source circuits, PNP transistors, Transistor switching networks, bias stabilization of transistors, Practical applications
5. **AC analysis of Bipolar Junction Transistors**
   Introduction, Application in AC domain, BJT Transistor modeling, r_e Transistor model of Common-Emitter fixed bias configuration, voltage divider bias, CE emitter-bias, Emitter follower, Common-base, Collector feedback , Collector DC feedback configuration, Current gain, effect of R_L and R_S
   Two port System Approach, cascaded systems, Darlington connection, Feedback pair, Hybrid equivalent model, approximate hybrid equivalent circuits, Hybrid π model, Practical Applications.

6. **MOS Field-Effect Transistors**
   Device Structure and Physical Operation, Current-Voltage Characteristics, MOSFET Circuits at DC, The MOSFET as an Amplifier and as a Switch, Biasing in MOS Amplifier Circuits, Small-Signal Operation and Models, Single-Stage MOS Amplifiers, The Depletion-Type MOSFET, JFET -construction, operation and characteristics

7. **Frequency Analysis of BJT and FET**
   Introduction, Decibels, general frequency consideration, Normalized Process, Low Frequency analysis of BJT and FET, Miller effect capacitance, High frequency response of BJT and FET, Square wave testing
8. **Power Amplifiers**
   Introduction, series –fed Class A amplifier, Transformer-Coupled Class A amplifier, Class B amplifier operation, Class B amplifier circuits, Amplifier distortion, Class C and Class D amplifier, Heat sink and its operation

D. **Lesson Planning**

Sr. No	No. of Hours	% Weightage in Exam	Topics
1	6	10	**Semiconductor Diodes** Introduction, Semiconductor materials, covalent bond and intrinsic materials, energy levels, extrinsic materials: p-type and n-type semiconductors, semiconductor diodes, ideal versus practical diodes, resistance levels, diode equivalent circuits, transition and diffusion capacitance, reverse recovery time, diode specification sheet, zener diode, Light Emitting diode, Tunnel diode, schottky diode, varicap diode
2	10	15	**Diode Circuits** Introduction, Load –line Analysis, Series Diode configuration, Parallel and series-parallel configurations, Typical diode circuits, Half-wave & Full wave rectifier, Clippers, Clampers, Zener Diode as voltage regulators, Voltage multiplier circuits, Practical Applications of diode circuits
3	10	15	**Bipolar Junction Transistor** Introduction, Transistor construction, Operation, Common-base configuration & characteristic, Transistor Amplifying action, Common-Emitter configuration & characteristic, Common-collector configuration & characteristic, Limits of operation, study of Transistor data sheet
4	08	10	**DC-biasing of Bipolar Junction Transistors** Introduction, operating point, Fixed biased configuration, Emitter-bias configuration, Voltage divider bias configuration, collector feedback configuration, Emitter follower configuration, Miscellaneous configuration, Design operations, current mirror circuits, current source circuits, PNP transistors, Transistor switching networks, bias stabilization of transistors, Practical applications
5	10	15	**AC analysis of Bipolar Junction Transistors** Introduction, Application in AC domain, BJT Transistor modeling, r_e Transistor model of Common-Emitter fixed bias configuration, voltage divider bias, CE emitter-bias, Emitter follower, Common-base, Collector feedback , Collector DC feedback configuration, Current gain, effect of R_L and R_S ,Two port System Approach, cascaded systems, Darlington connection, Feedback pair, Hybrid equivalent model, approximate hybrid equivalent circuits, Hybrid π model, Practical Applications

6	08	15	**MOS Field-Effect Transistors** Device Structure and Physical Operation, Current-Voltage Characteristics, MOSFET Circuits at DC, The MOSFET as an Amplifier and as a Switch, Biasing in MOS Amplifier Circuits, Small-Signal Operation and Models, Single-Stage MOS Amplifiers, The Depletion-Type MOSFET, JFET -construction, operation and characteristics
7	4	10	**Frequency Analysis of BJT and FET** Introduction, Decibels, general frequency consideration, Normalized Process, Low Frequency analysis of BJT and FET, Miller effect capacitance, High frequency response of BJT and FET, Square wave testing
8	4	10	**Power Amplifiers** Introduction, series –fed Class A amplifier, Transformer-Coupled Class A amplifier, Class B amplifier operation, Class B amplifier circuits, Amplifier distortion, Class C and Class D amplifier, Heat sink and its operation
	60	**100**	**Total**

E. Instructional Method & Pedagogy

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- Two internal exams may be conducted and average of the same may be converted to equivalent of 15 marks as a part of internal theory evaluation.
- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. Itmaycarry a weight age of five marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar /Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures.
- Experiments shall be performed in the laboratory related to course contents.

F. Suggested List of Experiments:

1. To study V-I characteristics of PN junction diode.
2. To study Half wave, full wave and Bridge Rectifier.
3. To study transistor characteristics in common base and common emitter configurations.
4. To study the FET characteristics
5. To design, study and compare various transistor biasing techniques.
6. To study of an emitter follower circuit.
7. To find Offset Voltage, Gain, CMRR of an Op-amp and study techniques of \ Offset null adjustment.
8. Diode clippers and clampers.
9. Study and experimental verification of MOSFET.
10. To study Class A amplifier.

G. Student Learning Outcome:

On successful completion of the course

- The student can acquire the basic knowledge of electronic circuits, semiconductor devices, thus being prepared to pursue any area of engineering spectrum in depth as desired.
- The students will be able to effectively understandelectronic circuits and lead the exploration of new applications and techniques for their use.

Text Books:

1. Millman&Halkias, "Integrated Electronics", McGraw Hill Publications, 1992.
2. Boylestad&Nashlesky, "Electronic Devices & Circuit Theory", PHI, 10th Edition.
3. Albert Malvino& David J. Bates, "Electronic Principles", Tata McGraw Hill, 7th Edition 2007
4. Floyd, "Electronic Devices", PHI, 7th Edition.

Reference Books:

1. Sedra, Smith, 'Microelectronic Circuits', Oxford University Press, fifth edition, 2004.
2. Paul Horowitz and Winfield Hill, 'The art of electronics', Cambridge university press, third edition, 2011.