	National Institute of Technology Meghalaya An Institute of National Importance	**CURRICULUM**

Programme	**Bachelor of Technology in Electronics and Communication Engineering**	Year of Regulation	**2018-19**
Department	**Electronics and Communication Engineering**	Semester	**VIII**

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
EC 420	**Advanced Semiconductor for RF and Power Application**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives		Course Outcomes		
	Advanced Compound Semiconductor (Especially III-V) basics		CO1	Able to understand basics of advanced compound semiconductor.
	Power and RF device basics		CO2	Able to learn basic of new device design.
	Basics of III-V device (Especially HEMT & HBT)		CO3	Able to apply knowledge on Power and RF circuit.
	III-V device (Especially HEMT & HBT) based circuit		CO4	Able to estimate device level optimization.

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO1	**3**	**3**	**-**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**3**	**-**	**3**
2	CO2	**3**	**3**	**-**	**1**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**2**	**-**	**2**
3	CO3	**2**	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**
4	CO4	**2**	**2**	**3**	**-**	**2**	**2**	**3**	**-**	**2**	**-**	**-**	**1**	**2**	**3**	**2**

SYLLABUS

No.	Content	Hours	COs
I	**Compound Semiconductor Basics:** Difference between Silicon and the compound semiconductor, Growth of epitaxial crystal, Interfaces, Hetero junction interface and Homo junction interface, Bandgap engineering, defects, trap, dislocation. Impact of lattice constant versus bandgap. Properties of Compound Semiconductor.	**12**	**CO1**
II	**High electron mobility transistor (HEMT):** Design of the HEMT device. Properties of HEMT. Design specs of RF HEMT and characteristics of the RF HEMT. Thermal management of the HEMT. Design specs of Power HEMT and characteristics of the Power HEMT.	**6**	**CO2**
III	**Hetero-junction bipolar design (HBT)** Difference between BJT and HBT. Design specs and characteristics of the HBT for power and RF device. Thermal management of the HBT. Optimization techniques for achieving the trade-off between the properties.	**6**	**CO2**
IV	**Design of Compound Semiconductor based RF circuit** Design of GaN based Power Amplifier, Low noise amplifier, Difference between monolithic microwave integrated circuit (MMIC) and radio-frequency integrated circuit (RFIC)	**6**	**CO3, CO4**
V	**Design of Compound Semiconductor based Power circuit** Design of GaN based DC-DC converter (especially buck and boost converter design). Difference between the properties of the silicon based buck and boost converter and GaN based buck and boost converter	**6**	**CO3, CO4**
	Total Hours	**36**	

Essential Readings

1. Hadis Morkoç, Handbook of Nitride Semiconductors and Devices: Materials Properties, Physics and Growth, Volume 1, John Wiley and Sons, 1st Edition, 2008.
2. Cheng, Keh Yung, III–V Compound Semiconductors and Devices, Springer Publications, 1st Edition, 2020.
3. Alex Lidow, M. de Rooij, J. Strydom, D. Reusch, and J. Glaser, GaN Transistors for Efficient Power Conversion, John Wiley and Sons, 3rd Edition, 2019.

Supplementary Readings

1. Fay, Patrick, Jena, Debdeep, Maki, Paul, High-Frequency GaN Electronic Devices, Springer Publications, 1st Edition, 2020.