

2056

M.E. Electrical Engineering (Power System)
Second Semester

EE-8204(a): Advanced Power Electronics Techniques and Devices for Power Systems

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt any five questions. Assume suitable data wherever necessary and clearly state the assumptions made.

x-x-x

Q.1	Classify power diodes based on reverse recovery time and compare them according to current rating , voltage rating, reverse recovery time, junction type and applications.	10
Q.2	Compare Power BJT, Power MOSFET, and IGBT with respect to their key characteristics such as type of charge carrier, control mechanism, switching speed, losses, ratings, and applications. Highlight at least eight differences.	10
Q.3	Critically analyze the phenomena of quasi-saturation and hard saturation in a power BJT , and evaluate their impact on charge storage, switching speed, and overall device performance in high-power switching applications.	10
Q.4	An IGBT in a converter carries a collector current of 25 A with a collector-emitter saturation voltage of 2 V. The device has a maximum collector-emitter breakdown voltage rating of 600 V and is used in a circuit with a DC supply of 400 V. Calculate the conduction loss in the IGBT and examine whether the device operates safely with respect to its breakdown voltage rating .	10
Q.5	A turn-on snubber circuit is used with a power device operating from a 200 V DC supply. The maximum allowable rate of rise of current di/dt is limited to 50 A/ μ s. If the load current rises to 25 A during turn-on, determine the minimum value of snubber inductance required to limit the current rise within safe limits.	10
Q.6	Evaluate the key features of IGBTs, including switching speed, conduction behaviour, thermal performance, and safe operating area, and propose their suitability for advanced applications such as electric drives or renewable energy systems.	10
Q.7	Critically analyze the construction and channel formation mechanism of a power MOSFET, and evaluate how these structural features influence its static and dynamic characteristics, including on-state resistance and switching performance.	10
Q.8	Describe string efficiency for series and parallel operation of thyristors. Discuss the problems associated with series and parallel connection of thyristors and provide the solutions for respective problems.	10

x-x-x