MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

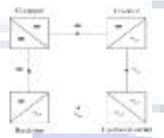
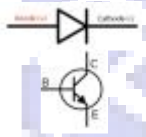
(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)

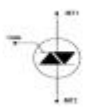
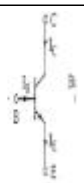
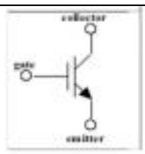
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

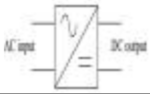
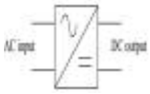
MUST KNOW CONCEPTS MKC

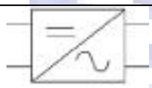
EEE **2021-22**

Course Code & Course Name : 19EEC07 & Power Electronics

S.No.	Term	Notation (Symbol)	Concept / Definition / Meaning / Units / Equation / Expression	Units
			UNIT I POWERSEMI-CONDUCTOR DEVICES	
1.	**Power Electronics**		It is defined as the application of solid state electronics for the control (source-load) and conversion of electrical power (ac-dc dc-dc, dc-ac, ac-ac).	Nil
2.	**Solid State Electronics**	Nil	They are made up of solid state semiconductor devices which is unable to move, and can control the rotating machines. Ex. Diode, SCR, MOSFET, IGBT, etc).	Nil
3.	**Signal level Electronics**		It is the study of semiconductor devices and the process of information/signal where the operating voltage and current is of signal level (Ex: max.30v, 0.5A).	Nil
4.	**Power level Electronics**		It is the study of semiconductor devices whose operating voltage and current is of power level (Ex: interms of KV, higher value of magnitude of currents).	Nil
5.	**Doping**	Nil	The amount of impurity added to a pure semiconductor.	Nil
6.	Depletion Region	Nil	A region in a P-N junction diode where no mobile charge carriers are present. Depletion layer acts like a barrier that opposes the flow of electrons from n-side and holes from p-side.	Nil
7.	Drift region	Nil	A region where the immobile acceptor and donor ions break.	Nil
8.	**Break down voltage**	V_{BO}	It is the minimum forward voltage at which gate being open, junction breaks down and the SCR starts conducting.	Volts
9.	**Knee /Cut-in/Threshold voltage**	V_K /V_{cut-in}	The minimum voltage at which the diode starts conducting and current starts increasing exponentially is called knee voltage of a diode. V_{cut-in} = 0.6V for silicon and 0.3V for germanium.	Volts
10.	**Peak Inverse Voltage**		The maximum voltage which diode can withstand without breakdown is called peak inverse voltage.	Volts
11.	Reverse Recovery Charge	Qrr	It is the charge accumulated within a diode rectifier that has experienced a forward current.	Coulombs

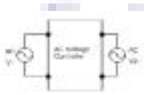
12.	Reverse recovery Time	t_{rr}	When switching from the conducting to the blocking state, a diode has stored charge that must first be discharged. This discharge takes a finite amount of time known as the Reverse Recovery Time.	µs
13.	**Latching current**	I_L	It is the minimum anode current, above which the SCR starts conducting and it is required to keep SCR in conducting state even after removal of gate pulse. $I_L > I_H$	mA
14.	**Holding current**	$\mathbf{I_H}$	It is the minimum anode current, below which the SCR turns-off. Hence, holding current is responsible for turn-off and latching current for turn off.	mA
15.	**Reverse Recovery Time**	T_{rr}	Reverse recovery time (T_{rr}) is the time taken to stop conducting when the diode is reverse biased.	seconds
16.	**Snubber Circuit**	Nil	Snubber circuits are needed to limit the rate of change in voltage or current (di/dt or dv/dt) and over voltage during turn-on and turn-off. Hence, it acts as a protection circuit.	Nil
17.	**V-I Characteristics**	Nil	A trainer kit is available in the laboratory to compare the ideal and practical V-I characteristics of SCR, TRIAC, GTO, MOSFET, IGBT.	Nil
18.	**Pinch-Off Voltage**	V_P	For MOSFET V_{GS}=0 V, the value of VDS at which ID becomes essentially constant is the pinch-off voltage, V_P.	Volts
19.	Commutation	-	Commutation-Turning-off from forward conducting state to forward blocking state.	-
20.	**Silicon Controlled rectifier**		It belongs to the family of thyristors and is a current-controlled four-layer solid state semiconductor device used as a controlled rectifier.	-
21.	**GTO-Gate Turn-off thyristor**		It belongs to the family of thyristors, where the turn –on and turn-off of the device is	-
22.	**TRIAC-Triode as an AC switch**		It is a bidirectional semiconductor device, where two thyristors are connected in antiparallel, can be integrated into a single device called TRIAC.	-
23.	**Power BJT-Bidirectional Junction Transistor**		It is a 3 terminal, three layer, 2 junction, current controlled semiconductor device in which the operation depends on the interaction of both the majority and minority charge carriers and hence the name bipolar.	-
24.	MOSFET- Metal Oxide Semiconductor Field Effect Transistor		It is a 3 terminal, three layer, voltage controlled high input impedance semiconductor device	-
25.	**IGBT-Insulated Gate Bipolar Junction Transistor**		It is a 3 terminal, three layer, voltage controlled, which possess high input impedance and high switching speeds of a MOSFET with the low saturation voltage of a bipolar	-

			transistor.	
UNIT II AC - DC CONVERTERS				
26.	**Converters**	Nil	A power electronic converter which uses power electronic components such as SCRs, TRIACs, IGBTs, etc. to control and convert the electric power.	Nil
27.	**Rectifier**		It converts the alternating current to pulsating direct current by suing semiconductor devices.	Nil
28.	**Controlled Rectifiers**		Controlled rectifiers are line commutated ac to dc power converters which are used to convert a fixed voltage, fixed frequency ac power supply into variable dc output voltage.	Nil
29.	**Uncontrolled Rectifiers**	Nil	It employs only diodes for rectification and the dc output voltage is fixed in amplitude.	Nil
30.	**Firing angle**	α	The angle measured from the instant that gives the largest output voltage to the instant it is triggered w.r.t the applied voltage.	Nil
31.	**Delay angle**	Nil	The delay angle is defined as the angle between the zero crossing of the input voltage and the instant the thyristor is fired.	Nil
32.	**One Pulse Converter**	Nil	It employs one pulse in each cycle of ac wave for obtaining the rectification process. Ex. Half wave controlled converter.	Nil
33.	**Semiconverters**	Nil	It is a single quadrant converter which has only one polarity of output voltage and current. It uses two SCRs and two diodes which are connected in bridge configuration.	Nil
34.	**Two Pulse converter**	Nil	It employs two pulses in each cycle of ac wave for obtaining the rectification process. Ex. 1-ϕ Full wave controlled converter.	Nil
35.	**Full converters**	Nil	It is a two quadrant converter whose voltage polarity can reverse, but the current direction cannot reverse. It uses four SCRs which are connected in bridge configuration.	Nil
36.	**Three pulse converter**	Nil	It employs three pulses in each cycle of ac wave for obtaining the rectification process. Ex. 3-ϕ Half wave controlled converter.	Nil
37.	**Six pulse converter**	Nil	It employs six pulses in each cycle of ac wave for obtaining the rectification process. Ex. 3-ϕ full wave controlled converter.	Nil
38.	**Dual Converter**	Nil	Two full converters connected in antiparallel and connected to the dc load, offering four quadrant operation.	Nil
39.	**Commutation**	Nil	The process of turning-off of a power semiconductor device.	Nil
40.	**Natural Commutation**	Nil	The semiconductor device is turned off naturally without using any circuit. If the source is AC this type of commutation is employed.	Nil
41.	**Forced Commutation**	Nil	It is an external commutation circuit required to turn-off the conducting semiconductor device. If the source is DC this type of commutation is	Nil

			mandatory.	
42.	**Freewheeling diode**	FWD	It maintains the load current to be continuous and is also used to improve the power factor of the system.	Nil
43.	**Ripple**	Nil	AC component present in the DC output voltage.	Nil
44.	**Overlap period**	μ	Both the incoming and outgoing thyristors conducts.	Nil
45.	**Extinction angle**	β	The angle β, where the thyristor gets switched off in spite of being reverse biased, this instant is called extinction angle.	Nil
46.	**Harmonics**	Nil	It is the integral multiple of fundamental frequency (f=50hz).	Nil
47.	Total Harmonic Distortion	THD	THD is the ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency.	Nil
48.	**Frequency**	f	Frequency is the number of complete cycles per second in alternating current direction.	Hz
49.	**Time period**	T=1/f	It is time required to complete one complete cycle T=1/f.	seconds
50.	**Performance validation**	Nil	Power circuit module, triggering unit and CRO is available in the laboratory to validate the performance of 1-ɸ and 3-ɸ half controlled and fully controlled converter.	Nil
UNIT III DC - AC CONVERTERS				
51.	**Inverter**		Convert fixed dc voltage to variable ac output voltage and frequency by employing forced commutation.	Nil
52.	**Inverter output**	Vo	Square wave output can produce with humming.	Nil
53.	**Square wave Inverter**	Nil	The practical output of an inverter is either a square or quasi-square inverter.	Nil
54.	**Pulse Generator**	Nil	Generates trigger pulses/firing pulses to trigger the power semiconductor devices.	Nil
55.	**Voltage source inverter**	VSI	It is a stiff/constant dc input voltage which remains constant irrespective of the load connected across the output terminals.	Nil
56.	**Current source inverter**	CSI	It is a stiff/constant dc input current source which remains constant irrespective of the load connected across the output terminals.	Nil
57.	Pulse Width Modulation	PWM	A fixed dc input voltage is given to the inverter and a controlled ac output voltage is obtained by adjusting the on and off periods of the inverter devices.	Nil
58.	**Single PWM**	Nil	In single pulse modulation, there is only one pulse exists per half cycle. The width of this pulse is varied to control the inverter output voltage.	Nil
59.	**Multiple PWM**	Nil	In MPWM, many pulses having equal widths are produced per every half cycle. The gating signals are produced by comparing reference signal with triangular carrier wave.	Nil

60.	**Sinusoidal PWM**	Nil	Gate pulses are generated by comparing sinusoidal reference signal with triangular carrier signal. Frequency of reference signal (f_r) decides the frequency of output voltage.	Nil
61.	**Modulation index**	m	Modulation index is the ratio of peak magnitudes of the modulating waveform and the carrier waveform.	Nil
62.	**Space vector modulation**	SVM	SVM is an algorithm for the control of pulse width modulation. It is used for the creation of alternating current (AC) waveforms; most commonly to drive 3 phase AC powered motors at varying speeds from DC.	Nil
63.	**Series inverter**	Nil	The commutating components (L&C) are connected in parallel with the load.	Nil
64.	**Parallel inverter**	Nil	The commutating components (L&C) are connected in series with the load thus forming an underdamped circuit.	Nil
65.	**Converter grade SCR**	Nil	Converters with slow turn-off time (50-100µS).	Nil
66.	**Inverter grade SCR**	Nil	Converters with fast turn-off time (3-50µS).	Nil
67.	**Performance validation**	Nil	The performance of Series and parallel, VSI, CSI can be validated in the laboratory using the trainer kits/discrete components.	Nil
68.	**Power Pollution**	Nil	Harmonics contributes power pollution which are the unwanted higher frequencies which superimposed on the fundamental waveform creating a distorted wave pattern.	Nil
69.	**Harmonics**	Nil	It is a integral multiple of the fundamental frequency (50Hz) and is a distortion of the normal electrical current waveform, generally transmitted by non-linear loads.	Nil
70.	**Odd harmonics**	Nil	Harmonics such as, 3,5,7,9,11,13… contributes odd harmonics.	Nil
71.	**Even harmonics**	Nil	Harmonics such as 2,4.6,8,10… contributes even harmonics.	Nil
72.	Total Harmonic Distortion	THD	Measurement of the harmonic distortion present in a signal and is defined as the ratio of the sum of the powers of all harmonic components to the power of the fundamental frequency.	Nil
73.	**180 degree mode VSI**	Nil	Here 3 SCRs conducts at an instant, each SCR conducts for 180^o or T/2 seconds.	Nil
74.	**120 degree mode VSI**	Nil	Here 2 SCRs conducts at an instant, each SCR conducts for 120^o or T/3 seconds.	Nil
75.	**Feedback diodes**	Nil	For RL loads, load current will not be in phase with load voltage and the diodes connected in antiparallel will allow the current to flow when the main thyristors are turned off. These diodes are called feedback diodes.	Nil
UNIT IV DC TO DC CONVERTERS				
76.	**AC Link chopper**	Nil	It is a traditional chopper, where dc is converted to ac and a transformer is used to neither increase or decrease the voltage, finally	Nil

			a controlled rectifier is used to obtain variable dc voltage.	
77.	**Duty Cycle**	α	It is defined as the ratio of on period to the total time period of the chopper. $\alpha = T_{On} / (T_{on} + T_{off})$.	%
78.	**Time period**	T	It is the sum of ON and OFF period of a semiconductor device which acts as a chopper, $T = T_{on} + T_{off}$.	seconds
79.	**Chopping frequency**	f	The corresponding time period, T for a chopper circuit determines the switching frequency, where T= 1/f.	Hz
80.	**Buck Converter**	Nil	It is a step down converter, which produces a lower average dc output voltage E_0 than the dc input voltage E_{dc}.	Nil
81.	**Boost Converter**	Nil	It is a step up converter, which produces a greater average dc output voltage E_0 than the dc input voltage E_{dc}.	Nil
82.	**Buck-Boost Converter**	Nil	It is cascade connection of buck and boost converter and the output voltage can be either decreased or increased with respect to the input voltage E_{dc}.	Nil
83.	**Frequency Modulation**	Nil	In frequency modulation control, the chopping frequency f (or the chopping period T) is varied.	Nil
84.	**Time-Ratio control**	TRC	Achieved by varying the Ton / T control.	seconds
85.	**Current Limit control**	CLC	Current is maintained between two limits.	Amps
86.	**Forced commutation**	Nil	Current is forced to zero for turn-off.	Nil
87.	**Voltage commutation**	Nil	The capacitor voltage reverse biases the conducting device and it turns Off.	Nil
88.	**Load commutation**	Nil	The load current becomes zero or is transferred to another device	Nil
89.	**Motoring**	Nil	It operates in Quadrant I of the V_o-I_o four quadrant plane, with operating in forward motoring mode.	Nil
90.	**Forward braking**	Nil	It operates in Quadrant II of the V_o-I_o four quadrant plane with operating in Generating or forward braking mode.	Nil
91.	**Reverse motoring**	Nil	It operates in Quadrant III of the V_o-I_o four quadrant plane,with operating in reverse motoring mode.	Nil
92.	**Reverse braking**	Nil	It operates in Quadrant IV of the V_o-I_o four quadrant plane, with operating in Generating or reverse braking mode.	Nil
93.	**Flyback converters**	Nil	It is a DC-DC converter, which are used to convert the unregulated dc input voltage into a controlled desired dc output voltage.	Nil
94.	**Cuk Converter**	Nil	It is a type of DC/DC converter that has an output voltage magnitude that is either greater than or less than the input voltage E_{dc}.	Nil
95.	**AC Link chopper**	Nil	It is a traditional chopper, where dc is converted to ac and a transformer is used to	Nil

			neither increase or decrease the voltage, finally a controlled rectifier is used to obtain variable dc voltage.	
96.	**Resonant Converter**	Nil	It is a type of electric power converter that contains a network of inductors and capacitors called a "resonant tank", tuned to resonate at a specific frequency.	Nil
97.	**High Frequency switching devices**	Nil	They are power semiconductor devices with faster turn-on and turn-off process to achieve the power conversion at a faster rate.	
98.	**Performance validation**	Nil	The performance of Step-up and Step-down choppers, Voltage and Current commutated chopper can be validated in the laboratory using the trainer kits/discrete components.	Nil
99.	**Linear Regulator**	Nil	As its name suggests, a linear regulator is one where a linear component (such as a resistive load) is used to regulate the output.	Nil
100.	**Switching Regulator**	Nil	A switching regulator is a voltage regulator that uses a switching element to transform the incoming power supply into a pulsed voltage, which is then smoothed using capacitors, inductors, and other elements.	Nil
UNIT V AC TO AC CONVERTERS				
101.	**Cycloconverter**	Nil	It is a power electronic converter, which converts the input power at one frequency to output power at another frequency/load frequency.	Nil
102.	**Frequency**	F	Alternating current (ac) frequency is the number of cycles per second in an ac sine wave. Power line frequency (normally 50 Hz or 60 Hz).	Hz
103.	**Time period**	T	The Period, (T) is the length of time in seconds that the waveform takes to repeat itself from start to finish. $T = T_{ON} + T_{OFF}$	Sec
104.	**AC voltage controllers/ AC regulators**		It is a power electronic converter, which converts a fixed voltage, fixed frequency alternating current to variable voltage, fixed frequency.	Nil
105.	**Unidirectional Controller/ Half wave ACVC**	Nil	It can only control positive or negative cycle of the AC Wave or say half wave therefore it can be used where there is only need of control half wave.	Nil
106.	**Half wave ACVC**	Nil	Single-phase half wave voltage regulator consists of a Thyristor and a diode in anti parallel. Therefore control is possible only in positive half cycle. The output waves are very much distorted. Therefore half wave regulator is not used.	Nil
107.	**Bidirectional controller**	Nil	It can control the ac power flow to the load in both the half cycles by adjusting the trigger angle ' ' α Controlled during both cycles of the input voltage.	Nil

108.	**Sequence control**	Nil	A two or more stages of ac voltage controllers in parallel for the regulation of output voltage.	Nil
109.	**Multi stage Sequence control**	Nil	While controlling two or more sequence control stages, there can be an enhancement in power factor and additional reduction in THD (total harmonic distortion).	Nil
110.	**On-Off Control**	Nil	In this technique, the thyristors are used as switches to connect the load circuit to the ac supply (source) for a few cycles of the input ac supply and then to disconnect it for few input cycles.	Nil
111.	**Integral Cycle Control**	Nil	In integral cycle control, thyristor switches connect the load to the AC source for a few cycles of input voltage and then disconnect it for another few cycles.	Nil
112.	**Phase Control**	Nil	The thyristor switch sets up a connection between the load and the AC source for only part of each cycle of the input voltage by adjusting the ac ac phase angle.	Nil
113.	**Duty cycle in ACVC**	Nil	Duty cycle = n / n + m where n = number of on-cycles; m = number of off-cycles	Nil
114.	**Step-up Cycloconverter**	Nil	If the output frequency is greater than the supply frequency, then it is called as step-up cycloconverters.	Nil
115.	**Step-down Cycloconverter**	Nil	If the output frequency is less than the supply frequency, then it is called as step-down cycloconverters.	Nil
116.	**1-ϕ-1- ϕ Cycloconverter**	Nil	It consists of two full wave converters that are linked back to back as shown below.	Nil
117.	**3-ϕ-1- ϕ Cycloconverter**		This type of converter can operates in four quadrants (+V, +I, -V, -I) in two modes (inverting and rectifying). Here; +V, +I are in rectifying modes and -V, -I are in inverting modes.	Nil
118.	**3-ϕ-3- ϕ Cycloconverter**	Nil	These types of Cycloconvertes are formed by using 3 three-phase to single cycloconverters linked together to the load and is used in AC machine systems.	Nil
119.	**Blocking Mode Cycloconverters**	Nil	The positive converter will provide the necessary voltage when there is positive load current where as at that time, the negative converter will be in the blocked condition.	Nil
120.	**Positive converter group**	Nil	The part of the cycloconverter circuit that permits the flow of current during positive half cycle of output current is called positive converter group.	Nil
121.	**Commutation in Cycloconverter**	Nil	Since the source is AC, line/natural commutation is employed.	Nil
122.	**Commutation in ACVC**	Nil	Since the source is AC, line/natural commutation is employed.	Nil
123.	**Negative converter**	Nil	The part of the cycloconverter circuit that	Nil

	group		permits the flow of current during negative half cycle of output current is called negative converter group.	
124.	**Matrix Converters**	Nil	It is a single stage of conversion ac-ac conversion without any intermediate energy storage element.	Nil
125.	**Performance validation**	Nil	The performance of cycloconverters, AC voltage controllers can be validated in the laboratory using the trainer kits which includes the power modules and triggering units/discrete components.	Nil
		Placement Questions		
126.	Tell me a little about yourself.			
127.	What are your biggest weaknesses?			
128.	What are your biggest strengths?			
129.	Where do you see yourself in five years?			
130.	Out of all the other candidates, why should we hire you?			
131.	How did you learn about the opening?			
132.	Why do you want this job?			
133.	What do you consider to be your biggest professional achievement?			
134.	Describe your dream job			
135.	Why do you want to leave your current job?			
136.	What kind of work environment do you like best?			
137.	Tell me the toughest decision you had to make in the last 6 months			
138.	What is your leadership style?			
139.	Tell me about a time you disagreed with a decision. What did you do?			
140.	Tell me how you think other people would describe you.			
141.	What can we expect from you in your first three months?			
142.	What do you like to do outside of work?			
143.	What was your salary in your last job?			
144.	What questions do you have for me?			
145.	What is your greatest professional achievement?			
146.	Can you explain why you changed career paths?			
147.	How do you deal with pressure or stressful situations?			
148.	What do you like to do outside of work?			
149.	Are you willing to relocate?			
150.	What is your biggest regret and why?			

Faculty Team Prepared **Signatures**

Dr R Sagayaraj P/EEE

Year/Sem/Sec : III / V / B

HoD