P.R. GOVERNMENT COLLEGE (A), KAKINADA
B.Sc. III Year - Electronics – Semester – 6
w.e.f. 2017-18 ADMITTED BATCH

PAPER – 8A 1 [Cluster Elective A 1]
POWER ELECTRONICS

3 Hours/Week [Total: 45 hrs] Credits: 3

Course Learning Outcomes

The subject aims:

- To study the characteristics of various power semiconductor devices.
- To understand the operation of power inverters.
- To study the operation of rectifiers with different loads.
- To understand the operation of different types of choppers.
- To understand the operation and controlling of motors.

Learning Outcomes:

Students will be able to:

- Explain the characteristics of various power semiconductor devices and analyze the static and dynamic characteristics of SCR's.
- Design firing circuits for SCR.
- Explain the operation of rectifiers with different loads.
- Analyze the operation of different types choppers.

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SYLLABUS

Unit- 1 (9 Lectures)

Power devices: Need for semiconductor power devices, Power diodes, Introduction to family of thyristors.

Silicon Controlled Rectifier (SCR): structure, I-V characteristics, Turn-On and Turn-Off characteristics, Factors affecting the characteristics of SCR, Control circuits design and Protection circuits.

Unit- 2 (9 Lectures)

Diac and Triac: Basic structure, working and V-I characteristics of diac and triac.

Insulated Gate Bipolar Transistors (IGBT): Basic structure, I-V Characteristics, switching characteristics.

Unit- 3 (9 Lectures)

Choppers: Basic chopper circuit, types of choppers (Type A-D), step-down chopper, step-up chopper, Morgan's chopper (operation only)

Unit-4 (9 Lectures)

Power Inverters: Need for commutating circuits and their various types, D.C. link inverters, Parallel capacitor commutated invertors with and without reactive feedback and its analysis, Series Inverter, bridge invertors.

Unit- 5 (9 Lectures)

Electromechanical Machines: DC Motors, Principle of operation, EMF equation, Back EMF, Factors controlling motor speed, AC motor (Induction Motor only), Rotor and stator, torque & speed of induction motor.

Suggested Books:

1. Power Electronics, K. Hari Babu, Scitech Publication.

2. Power Electronics, P.C.Sen, TMH

3. Power Electronics & Controls, S.K. Dutta

4. Power Electronics, M.D.Singh&K.B. Khanchandani, TMH

5. Power Electronics Circuits, Devices and Applications, 3rd Edition, .H.Rashid, Pearson Education

6. Power Electronics, Applications and Design, Ned Mohan, Tore.

7. Power Electronics, P.C.Sen, TMH.

8. Power Electronics, M.S.Jamil Asghar, PHI.

9. A Textbook of Electrical Technology-Vol-II, B.L.Thareja, A.K.Thareja, S.Chand

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Model Question Paper

Note: - Set the question paper as per the blue print given at the end of this model paper.

TIME: 2 1/2 Hrs Max Marks: 60

Section	Questions to be given	Questions to be answered	Marks
A	5	3	3 x 10M = 30M
B	9	6	6 x 5 M = 30M
Total	**14**	9	60M

Blue Print

Chapter Name	Essay Questions 10 marks	Short Questions 5 marks	Marks allotted
Unit - 1	1	2	20
Unit – 2	1	2	20
Unit – 3	1	2	20
Unit – 4	1	2	20
Unit – 5	1	1	15
Total marks			95

PAPER – 8 A 1 [Cluster Elective A 1]
POWER ELECTRONICS
QUESTION BANK

ESSAY ANSWER TYPE QUESTIONS

UNIT-I:Power devices and Silicon Controlled Rectifier (SCR)

1. Draw the SCR structure, I-V characteristics and explain them.
2. Explain about Turn-On and Turn-Off characteristics, Factors affecting the characteristics of SCR.
3. Explain about Control circuits design and Protection circuits.
4. Explain need for semiconductor power devices, Power diodes.

UNIT-II:Diac and Triac, Insulated Gate Bipolar Transistors (IGBT)

1. Basic structure, working and V-I characteristics of diac.
2. Basic structure, working and V-I characteristics of triac.
3. Draw and explain IGBT Basic structure, I-V Characteristics, switching characteristics.
4. Explain about the V-I characteristics of diac, triac, IGBT.

UNIT-III:Choppers

1. Draw the Basic chopper circuit and explain its working.
2. Explain the operation of step-down chopper, step-up chopper, Morgan's chopper.
3. What are the types of choppers and explain any two types in detail.

UNIT-IV:Power Inverters

1. What is the Need for commutating circuits and explain their various types.
2. Write a notes on Parallel capacitor commutated invertors with reactive feedback and its analysis.
3. Write a notes on Parallel capacitor commutated invertors without reactive feedback and its analysis.
4. What are Series Inverter, bridge invertors and explain them.

UNIT-V:Electromechanical Machines

1. Write about EMF equation, Back EMF.
2. Explain the working of AC motor (Induction Motor only), Rotor and stator.
3. Write notes on DC motors, types of DC motor and its working.
4. What are the factors that control motor speed? Also explain torque & speed of induction motor.

SHORT ANSWER TYPE QUESTIONS

UNIT-I:Power devices and Silicon Controlled Rectifier (SCR)

1. Draw the SCR structure
2. What are the Factors affecting the characteristics of SCR?
3. Draw the control circuit design.
4. What is the need of semiconductor power devices?

UNIT-II:Diac and Triac, Insulated Gate Bipolar Transistors (IGBT)

1. Draw the basic structure if diac.
2. Draw the basic structure of triac.
3. Draw the structure of IGBT.
4. Explain about the V-I characteristics of diac, triac.

UNIT-III:Choppers

1. Draw the basic chopper circuit and explain.
2. What are the types of choppers and explain any 2 types in brief.
3. Explain about step-down chopper, step-up chopper.
4. Explain the operation of Morgan's chopper.

UNIT-IV:Power Inverters

1. What is the Need for commutating circuits?
2. What are the various types of commutating circuits? Explain in brief.
3. Explain in detail about Series Inverter.
4. Explain in detail about bridge invertor.

UNIT-V:Electromechanical Machines

1. Explain the principle of working operation of D.C. motors.
2. What are the factors controlling speed of the motor?
3. Explain about stator and rotor of A.C. motor.
4. Write about torque & speed characteristics of induction motor.