



B.E DEGREE EXAMINATIONS: MAY 2017

(Regulation 2014)

Sixth Semester

ELECTRICAL AND ELECTRONICS ENGINEERING

U14EET603: Solid State Drives

COURSE OUTCOMES

CO1: Compare different types of loads, Characteristics of motors and choose the motor for specific applications.

CO2: Construct the power converter circuit for ac and dc motor drives.

CO3: Apply the various control schemes of ac and dc drives in real time.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Matching type item with multiple choice code

CO2 [K₁]

List I	List II
A. Chopper	i. AC to DC conversion
B. Phase controlled line commutated rectifier	ii. Variable voltage at fixed frequency
C. Cycloconverter	iii. Constant DC voltage to variable dc voltage
D. AC voltage controller	iv. Variable voltage and variable frequency

- | | A | B | C | D |
|----|-----|-----|-----|-----|
| a) | i | ii | iii | iv |
| b) | iv | iii | ii | i |
| c) | ii | iv | i | iii |
| d) | iii | i | iv | ii |

2. Regeneration is not possible in a DC series motor, Since

CO1 [K₁]

- | | |
|--|---|
| a) I_f is not greater than I_a | b) I_f is not less than I_a |
| c) I_f is greater than or equal to I_a | d) I_f is less than or equal to I_a |

3. Consider the following statements CO2 [K₁]
1. Chopper circuits are used to control both shunt and series motor.
 2. Battery fed Chopper drive has good power factor and voltage regulations.
 3. Battery fed Chopper drive has good power factor but poor voltage regulations.
 4. Battery fed Chopper drive has poor power factor and good voltage regulations.
- Which of these statements are correct?
- a) 1,2 b) 3,4
c) 1,4 d) 2,4
4. A variable speed 3 Φ induction motor drive obtained by varying applied voltage is suitable for CO1 [K₃]
- a) Driving constant torque load b) Driving fan type loads where $T \propto N^2$
c) Driving load where $T \propto N^{-2}$ d) Driving all types of load
5. Assertion (A): The output voltage wave form of a inverter has more harmonic content CO3 [K₁]
Reason (R): Selective harmonic elimination technique remove all the lower order harmonics
- a) Both A and R are Individually true and R is the correct explanation of A b) Both A and R are Individually true but R is not the correct explanation of A
c) A is true but R is false d) A is false but R is true
6. PWM inverter fed induction motor drive can be operated in CO3 [K₁]
- a) Single quadrant b) Two quadrant
c) Three quadrant d) Four quadrant
7. Consider the following elements to build an electric drive CO1 [K₁]
1. Mechanical load 2. Power supply 3.Speed and torque controller 4. Drive motor
- The correct sequence of an electric drive system
- a) 2-3-4-1 b) 1-3-2-4
c) 3-4-2-1 d) 4-1-3-2
8. For steel rolling mill application CO1 [K₁]
- a) VSI fed induction motors used b) Cycloconverter fed DC motors used
c) Cycloconverter fed synchronous motors used d) Voltage controller fed induction motors used
9. Assertion (A): The efficiency of the group drive is low CO1 [K₁]
Reason (R): The losses occurring in several transmitting mechanisms
- a) Both A and R are Individually true and R is the correct explanation of A b) Both A and R are Individually true but R is not the correct explanation of A
c) A is true but R is false d) A is false but R is true

10. By self control of a synchronous motor means that CO3 [K₃]
- a) Elimination of torque ripple b) The speed of the motor is varied in steps
- c) The input frequency is controlled from the speed of the motor d) The speed of the motor is a function of input frequency

PART B (10 x 2 = 20 Marks)

(Answer not more than 40 words)

11. What are the three modes of operation of electric drive? CO1 [K₁]
12. What is dynamic torque? CO1 [K₁]
13. Give the speed torque equation of single phase fully controlled converter fed DC separately excited motor. CO2 [K₅]
14. Can a semi converter fed DC drive operated in 4th quadrant? Justify your answer. CO3 [K₄]
15. What are the advantages of chopper fed drive? CO2 [K₁]
16. What is CLC in chopper fed drive? CO2 [K₁]
17. What is slip power recovery scheme? CO3 [K₂]
18. What are the drawbacks of stator voltage control method? CO3 [K₁]
19. Define self-control technique of synchronous motor. CO3 [K₁]
20. What are the modes of adjustable frequency control in synchronous motor drive? CO3 [K₁]

Answer any FIVE Questions:-

PART C (5 x 14 = 70 Marks)

(Answer not more than 300 words)

Q. No. 21 is Compulsory

21. i) A 230V, 1200rpm, 13A separately excited Dc motor has an armature circuit (10) CO3 [K₆]
resistance and inductance of 2Ω and 100mH respectively. It is fed from a single phase half controlled rectifier with an AC source voltage of 230V, 50Hz. Calculate (i) Motor torque for $\alpha= 60^\circ$ and N= 600rpm (ii) Motor speed for $\alpha= 60^\circ$ and torque 20Nm.
- ii) Explain the concept of V/F control (4) CO3 [K₂]
22. (i) Derive an equation to find equivalent load torque in a motor load system in (5) CO1 [K₃]
translation and rotational motion.
- (ii) Give the speed torque characteristics for different types of loads. (9) CO1 [K₁]

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|--|-----|-------------------|
| 23. Explain with neat diagram and waveforms the operation of 3Φ , fully controlled converter fed DC separately excited motor. | CO2 | [K ₂] |
| 24. Explain different modes of chopper control for separately excited DC motor drive. | CO2 | [K ₂] |
| 25. Describe the conventional Kramer and Scherbius system with neat diagrams. | CO3 | [K ₂] |
| 26. Explain the V/F control of Synchronous motor drive. | CO3 | [K ₂] |
| 27. Explain the closed loop operation of permanent magnet synchronous motor drive in detail. | CO3 | [K ₂] |
