Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title:	**DC MACHINES AND ALTERNATORS**	Course Code	: 15EE31T
Semester	: **III**	Course Group	: **Core**
Teaching Scheme (L:T:P)	: **4:0:0** (in Hours)	Credits	: **4 Credits**
Type of course	: **Lecture + Assignments**	Total Contact Hours	: **52**
CIE	: **25Marks**	SEE	: **100 Marks**

Pre-requisites	**:** Elements of Electrical Engineering and Electrical Circuit Theory.
Course Objectives	**:** To learn working principle, construction, operation and performance of D.C. Generator, D.C Motor, special Motors and Alternators.

Course Topics:

Unit No	Unit Name	Hours
1	DC Generators construction and working	08
2	Performance of DC Generator	06
3	DC Motors	12
4	Alternators construction and working	08
5	Alternators performance	12
6	Special Machines	06
	Total	**52**

CourseOutcomes

On successful completion of the course, the student will be able to:

1. Explain the working of DC Generators, Winding types and EMF equation.

2. Analyze Armature reaction in DC Generators, Commutation, and different characteristics including efficiency and voltage regulation.

3. Understand working of DC Motors, and analyze types of DC motors, their characteristics, speed control and starting methods.

4. Explain the working of Alternators, Armature reaction and EMF equation.

5. Analyze Alternators for voltage regulation, parallel operation, excitation methods and understand hunting and cooling.

6. Differentiate different special purpose motors for their construction, working and applications.

Composition of Educational Components

Questions for CIE and SEE will be designed to evaluate the various educational components (Bloom's Taxonomy) such as:

Sl. No.	Educational Component	Weightage (%)	Total Marks (Out of 145)
1	Remembering	10	15
2	Understanding	55	80
3	Application/ Analysis	35	50
Total		**100**	**145**

Course Outcome linkage to Cognitive Level

Cognitive Level Legend: R- Remember, U- Understand, A- Application

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Explain the working of DC Generators, Winding types and EMF equation.	***R/U/A***	2, 10	8
CO2	Analyze Armature reaction in DC Generators, Commutation, and different characteristics including efficiency and voltage regulation.	***U/A***	2, 10	6
CO3	Understand working of DC Motors, and analyze types of DC motors, their characteristics, speed control and starting methods.	***R/U/A***	2, 10	12
CO4	Explain the working of Alternators, Armature reaction and EMF equation.	***U/A***	2, 10	8
C05	Analyze Alternators for voltage regulation, parallel operation, excitation methods and understand hunting and cooling.	***U/A***	2,10	12
C06	Differentiate different special purpose motors for their construction, working and applications.	***U***	2, 6,10	6
		Total sessions		**52**

Course Content and Blue Print of Marks for SEE:

Unit No	Unit Name	Hour	Max. Marks per Unit	Questions to be set for (5marks) PART - A			Questions to be set for (10marks) PART - B			Marks weightage (%)
				R	U	A	R	U	A	
1	DC Generators construction and working	08	25	1	1			0.5	1	17
2	Performance of DC Generator	06	15			1		1		10
3	DC Motors	12	35	1	1		0.5	1	1	25
4	Alternators construction and working	08	25		1	1		0.5	1	17
5	Alternators performance	12	30		1			1.5	1	21
6	Special Machines	06	15		1			1		10
	Total	**52**	**145**	**9 (45 Marks)**			**10 (100 Marks)**			**100**

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
DC Machines and Alternators	-	**3**	-	-	-	**1**	-	-	-	**3**

LEVEL 3- HIGHLY ADDRESSED, LEVEL 2-MODERATELY ADDRESSED, LEVEL 1-LOW ADDRESSED.

METHOD IS TO RELATE THE LEVEL OF PO WITH THE NUMBER OF HOURS DEVOTED TO THE COS WHICH ADDRESS THE GIVEN PO.
IF ≥40% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 3
IF 25 TO 40% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 2
IF 5 TO 25% OF CLASSROOM SESSIONS ADDRESSING A PARTICULAR PO, IT IS CONSIDERED THAT PO IS ADDRESSED AT LEVEL 1
If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Course Content:

Unit 1

D.C. GENERATORS CONSTRUCTION AND WORKING **08hrs**

Working principle of D.C. Generator - Principle, Simple loop Generator, Direction of induced E.M.F.
Construction and types of D.C Generators - Construction -Yoke, Armature, field poles, field coils, Commutator, brushes-Materials used for construction -properties of these materials-Reasons for using these materials -slot insulation materials -properties. Functions of each part in brief. Types of DC generators with circuit representation.
Armature windings- Types of windings, Rules of lap & wave winding, application of lap & Wave windings.
Induced E.M.F- E.M.F equation & problems.

Unit 2

PERFORMANCE OF D.C. GENERATORS **06hrs**

Armature reaction-Explanation of armature reaction with sketches, De-magnetizing & cross - magnetizing effect, Compensating winding.
Commutation-Definition-Explanation -methods of improving commutation.
Characteristics-Open circuit, internal, external characteristics of separately excited D.C. Generator: - OCC of shunt Generator -critical resistance- conditions for voltage build up-failure to build up -internal & External characteristics of shunt Generator.
Efficiency & voltage Regulation-Losses in D.C. Generator, Efficiency, voltage regulation & its importance-simple problems.

Unit 3

D.C.MOTORS **12hrs**

Principal of D.C Motor- Working principle –comparison of motor & Generator action. Back emf & voltage equation & simple problems.
Types of motors- Self excited shunt, series & compound motors, Torque developed by D.C motors. Meaning of Torque & torque equation [no derivation]
Motors- Torque speed relationship
Characteristics of D.C. Motors - Torque – Speed, Speed – Load and Torque – Load Characteristics of Series, Shunt & Compound motors – their Applications.
Speed control- Methods of speed control – shunt field control – armature resistance control Electronic speed control [Block diagram]
Starting Devices-Necessity of starter-construction & operation of 3 point starter.

Unit 4

ALTERNATOR CONSTRUCTION AND WORKING **08hrs**

Alternator Principle – Construction – Types. **Armature winding-**Types of armature windings, full pitch and fractional pitch windings and their advantages and dis-advantages.
Emf equation- Relationship between P,N,f, emf equation, and Problems.
Armature Reaction-Armature reaction in an alternator with sketches. Effects of load pf's on armature reaction. Effects of armature reaction on terminal voltage.

Unit 5

ALTERNATOR PERFORMANCE **12hrs**

Voltage regulation - Procedure for conducting O.C & S.C. tests on alternator with circuit arrangements Definition of effective resistance, leakage reactance & synchronous reactance. Calculate the synchronous impedance by O.C. & S.C. test results. Vector diagram of alternator on Load at different power factors. Equation for the no-load terminal voltage at different power factors. Voltage regulation - Definition. and methods to find voltage regulation. Determine regulation of 3-phase alternator by conducting O.C & S.C tests by EMF method.
Parallel operation - Conditions for parallel operation of single phase & three phase alternators, Parallel operation of three phase alternators using synchronoscope.
Excitation Systems - Meaning and types of excitation. Static excitation system.
Un-equal voltage - Effect of un-equal voltage on load sharing. Effect of change in excitation and prime mover input power on distribution of load.
Hunting and its prevention - Hunting in alternators and its prevention.
Cooling - Necessity of cooling in alternators. Cooling agents. - Hydrogen cooling

Unit 6

SPECIAL MACHINES **06hrs**

Principle of working, construction and applications of the following motors - Universal motors, Reluctance motor, Two phase Four pole Permanent magnet Stepper motor, Servo motor, Brushless D.C. Motors and AC/DC Tacho-generator.

REFERENCE BOOKS

1. Electrical Technology volume 2 - BL Theraja & A.K.Theraja S.Chand publication
2. Principles of Electrical Machines by V.K.Mehtha.S.Chand publication
3. Electrical Machines by M.N. Bandyopadhyay PHI Learning Pvt. Ltd.
3. Electrical Machines by Bhattacharya. Tata McGraw Hill Co.
4. Electrical Machines - J.B.Guptha Kataria & Sons Publications.
5. Generation of Electrical Energy by BR Gupta. S.Chand Publication.
6. Fundamentals of elecrical drives - G.K. Dubey Narosa publications.
7. Electrical Machines – Deshpande.

E-Resources

1. http://www.schandgroup.com
2. http://phindia.com
3. http://ikbooks.com

Course Delivery:

The Course will be delivered through lectures, classroom interaction, animations, group discussion, exercises and assignments.

Course Assessment and Evaluation

	What		To Whom	Frequency	Max Marks	Evidence Collected	Course Outcomes
Direct Assessment	CIE (Continuous Internal Evaluation)	I A Tests	Students	Three IA tests for Theory: (Average marks of Three Tests to be computed).	20	Blue Books	1 to 6
		Classroom Assignments		Student Activity	05	Handwritten Report	1 to 6
				TOTAL	**25**		
	SEE (Semester End Examination)	End Exam	Students	End Of the Course	100	Answer Scripts at BTE	1 to 6
Indirect Assessment	Student Feedback on course		Students	Middle Of The Course	Feed Back Forms		1 to 3
	End Of Course Survey			End Of The Course	Questionnaires		1 to 6

*__CIE__ – Continuous Internal Evaluation *__SEE__ – Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

Course Contents with Lecture Schedule:

Lesson No./ Session No.	Contents	Duration
Unit 1	**D.C. Generators construction and working**	**08 Hours**
1.	Introduction to Generator	01 Hour
2.	E.M.F induced in a Simple loop Generator and its direction.	01 Hour
3.	Construction of Yoke, Armature, Field poles, Field coils, Commutator, brushes. Properties of materials used in construction. Function of each part.	01 Hour
4.	Types of DC Generators and draw their circuit diagrams.	01 Hour
5.	Types of Armature windings, Rules of Lap windings and their application.	01 Hour
6.	Rules of Wave windings and their application.	01 Hour
7.	Derive induced E.M.F of a dc generator	01 Hour
8.	Problems on induced E.M.F	01 Hour
Unit 2	**Performance of DC Generator**	**06 Hours**
9.	Armature Reaction, De-magnetizing and Cross-magnetizing effect with sketches.	01 Hour
10.	Compensating winding.	01 Hour
11.	Commutation	01 Hour
12.	Methods of improving Commutation.	01 Hour
13.	Separately excited DC generator – Open circuit, internal, external characteristics.	01 Hour
14.	Shunt Generator – Open Circuit Characteristics, Critical Resistance, and Conditions for voltage build up, Internal and External Characteristics.	01 Hour
Unit 3	**DC Motors**	**12 Hours**
15.	Working principle -comparison of motor & Generator action.	01 Hour
16.	Back emf & voltage equation & simple problems.	01 Hour

Lesson No./ Session No.	Contents	Duration
17	**Types of motors:** shunt, series & compound Motors draw their circuit diagrams with voltage equations.	01 Hour
18	Torque developed by D.C motors. Meaning of Torque & torque equation[no derivation]	01 Hour
19	Problems on Torque and Speed of DC motors.	01 Hour
20	Torque – Speed, Speed – Load and Torque – Load Characteristics of Series, Shunt Motors.	01 Hour
21	Torque – Speed, Speed – Load and Torque – Load Characteristics of Compound Motors and Applications of Motors.	01 Hour
22	Methods of speed control of shunt motor, Explanation of Field control method.	01 Hour
23	Explanation of speed control of DC motor by Armature resistance method.	01 Hour
24	Block diagram of Electronic speed control.	01 Hour
25	Necessity of Starter in DC motor.	01 Hour
26	Construction and operation of 3-point starter.	01 Hour
Unit 4	**Alternator construction and working**	**08 Hours**
27	Introduction to alternators.	01 Hour
28	Basic principle of Alternator.	01 Hour
29	Construction of salient pole types of rotors.	01 Hour
30	Construction of non-salient pole types of rotors.	01 Hour
31	Full pitch Armature windings and Fractional pitch Armature windings.	01 Hour
32	Advantages and dis-advantages of Full pitch and Fractional pitch Armature windings.	01 Hour
33	Relationship between P,N,f and Derivation of emf equation.	01 Hour
34	Simple problems on E.M.F equation.	01 Hour

Lesson No./ Session No.	Contents	Duration
Unit 5	**Alternators performance**	**12 Hours**
36	Armature reaction in an alternator with sketches	01 Hour
37	Effects of p.f of load on armature reaction and Effects of armature reaction on terminal voltage.	01 Hour
38	Procedure for conducting O.C & S.C. tests on alternator with circuit arrangements Determine regulation of 3-phase alternator by conducting O.C & S.C tests by EMF method.	01 Hour
39	Definition of effective resistance, leakage reactance & synchronous reactance. Calculate the synchronous impedance by O.C. & S.C test results.	01 Hour
40	Vector diagram of alternator on Load at different power factors.	01 Hour
41	Equation for the no-load terminal voltage at different power factors. Voltage regulation definition and methods.	01 Hour
42	Necessity and Conditions for parallel operation of three phase alternators.	01 Hour
43	Parallel operation of three phase alternators using synchronoscope.	01 Hour
44	Meaning and types of excitation. Static excitation system.	01 Hour
45	Effect of un-equal voltage on load sharing. Effect of change in excitation and prime mover input power on distribution of load.	01 Hour
46	Hunting and its prevention in alternator.	01 Hour
47	Necessity of cooling in alternators. Cooling agents. - Hydrogen cooling.	01 Hour
Unit 6	**Special Machines**	**6 Hours**
48	working, construction and applications of Universal Motors	01 Hour
49	working, construction and applications of Reluctance Motor	01 Hour
50	working, construction and applications of Two phase , Four Pole Permanent magnet Stepper Motor	01 Hour
52	working, construction and applications of Servo Motor	01 Hour

Lesson No./ Session No.	Contents	Duration
53	working, construction and applications of Brushless D.C. Motors	01 Hour
54	DC and AC Tachogenerators- construction, working and applications.	01 Hour

Suggested Student Activities:

Each Student has to prepare and submit at least 3 pages of self hand written report (Construction details, type of windings used, Insulating materials used, cooling methods, applications etc.,) preferably by visiting a nearby Substation/ Power station/ Industry/ Factory etc., considering any one of the following topics.

1. DC Generators & DC Motors
2. Alternators
3. Special Machines
4. Cooling methods in Alternators
5. DC Motor Speed control techniques

MODEL OF RUBRICS / CRITERIA FOR ASSESSING STUDENT ACTIVITY (Course Coordinator)

Dimension	Scale					Students score (Group of five students)				
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	1	2	3	4	5
1	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	3				
2	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	2				
3	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	5				
4	Descriptor	Descriptor	Descriptor	Descriptor	Descriptor	4				
Note: Concerned faculty (Course coordinator) must devise appropriate rubrics/criteria for assessing Student activity for 5 marks **One activity on any one CO (course outcome) may be given to a group of FIVE students** **Grand Average/Total**						14/4 =3.5 ≈4				

Example only: MODEL OF RUBRICS / CRITERIA FOR ASSESSING STUDENT ACTIVITY-
Task given- Industrial visit and report writing

Dimension	Scale					Students score (Five students)				
	1 Unsatisfactory	2 Developing	3 Satisfactory	4 Good	5 Exemplary	1	2	3	4	5
1.Organisation	Has not included relevant info	Has included few relevant info	Has included some relevant info	Has included many relevant info	Has included all relevant info needed	3				
2. Fulfill team's roles & duties	Does not perform any duties assigned	Performs very little duties	Performs partial duties	Performs nearly all duties	Performs all duties of assigned team roles	2				
3.Conclusion	Poor	Less Effective	Partially effective	Summarises but not exact.	Most Effective	5				
4.Conversions	Frequent Error	More Error	Some Error	Occasional Error	No Error	4				
					Total marks	14/4=3.5 ≈4				

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
Ex: I test/6 th weak of sem 10-11 Am	I/II SEM		20
	Year:		

Name of Course coordinator : Units:__
CO's:____

Question no	Question	MARKS	CL	CO	PO
1					
2					
3					
4					

Note: Internal Choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks
1st Test/ 6 th week,	III SEM, E & E Engg	**DC Machines and Alternators**	20
9 Feb 16, 10-11 AM	Year: 2015-16	Course code:15EE31T	

Name of Course coordinator :
Units Covered :1 and 2
Course Outcomes : 1 and 2

Instruction : *(1). Answer all questions (2). Each question carries five marks*

Question No.	Question	CL	CO	PO
1	Define dc generator and mention the important parts of dc generator.	R	1	2,10
2	Explain de-magnetizing and cross magnetizing effects OR A DC generator of an 6 pole ,54slots,16 conductors per slot,1000rpm wave wound, useful flux per pole is 6.5mwb.calculate the generated voltage.	U A	1	2,10
3	Draw the Internal Characteristics of separately excited D.C. generator OR List the causes for the failure of voltage build up in a D.C shunt generator.	U U	2	2,10
4	Draw the O.C.C. of a D.C. shunt generator and determine the critical field resistance.	A	2	2,10

CL: Cognitive Level, R-Remember, U-Understand, A-Application, PO: Program Outcomes

Model Question Paper:

Code:15EE31T

III Semester Diploma Examination

Department of Electrical and Electronics Engineering

DC MACHINES AND ALTERNATORS

Time: 3 Hours][Max Marks: 100

***Note*:** i) Answer any SIX questions from PART - A. Each question caries 5 marks.
ii) Answer any SEVEN Questions from PART - B. Each question caries 10 marks.

PART – A

1. Explain the working principle of a dc generator.
2. Draw the neat sketch of a dc generator and label the parts.
3. What is armature reaction? List its effects.
4. Illustrate the significance of back emf.
5. State the applications of shun t motor.
6. Describe the construction of salient type alternator.
7. Compute the relation between P,N,f.
8. Define effective resistance, leakage reactance & synchronous reactance.
9. State the applications of stepper motor.

PART – B

1. a) Name the properties of material used in dc generators. 4
   b) A DC generator of an 6 pole, 54slots, 16 conductors per slot, 1000rpm wave Wound, useful flux per pole is 6.5mwb.calculate the generated voltage. 6

2. a) Draw the O.C.C. of a D.C. shunt generator and determine the critical field resistance. 6
   b) State the condition for maximum efficiency. 4

3. a) Classify D.C. motor and write their voltage equations. 4
   b) Define torque, Write expressions for shaft Torque, Armature Torque. 6

4. a) Explain the process of voltage build up of a DC shunt generator. 5
   b) List the applications of shunt generator. 5

5. a) A 3-phase, 16-pole alternator has a star-connected winding with 144 slots and10 conductors per slots. The flux per pole is 0.03 wb, sinusoidally distributed and the speed is 375rpm. Find the frequency rpm and the phase and line emf. Assume full-pitched coil. 6

b) Explain the armature reaction in an alternator with neat sketches. 4

6. a) Discuss the effects of lagging p.f of load on armature reaction. 6
b) Illustrate the effects of armature reaction on terminal voltage. 4

7. a) Explain EMF method of finding regulation of alternator. 6
b) State the necessity and conditions for parallel operation of three alternators. 4

8. a) Explain with neat circuit diagram the static excitation of an alternator. 5
b) Explain the effect of un-equal voltage on load sharing. 5

9 . a) Explain how is Hunting Prevented in alternators? 5
b) Explain the construction and working of a brushless DC motor. 5

10. a) Explain the construction and working of a universal motor. 5
b) Explain the construction and working of a servo motor. 5

Model Question Paper Bank

Course Title: **DC MACHINES AND ALTERNATORS**	Course Code : 15EE31T

Unit -1

Cognitive Level: REMEMBER

1. Define dc generator and mention the important parts of dc generator.
2. List the any five parts of dc generator with material and their functions.
3. Name the properties of material used in dc generators.
4. Define and explain the commutation.
5. Mention the reason for poor commutation.

Cognitive Level: UNDERSTAND

6. Explain the working principle of a dc generator.
7. Draw the neat sketch of a dc generator and label the parts.
8. Derive EMF equation of a DC generator.
9. What is armature reaction? List its effects.
10. Classify the dc generators according to field excitation.
11. Explain de-magnetising and cross magnetising effects
12. Explain with sketch Resistance commutation

Cognitive Level: APPLICATION

13. A DC generator of an 6 pole ,54slots,16 conductors per slot,1000rpm wave wound, useful flux per pole is 6.5mwb.calculate the generated voltage.
14. Explain separately excited dc generators with their circuits and voltage equations.
15. Explain dc series generators with their circuits and voltage equations.
16. Explain dc shunt generators with their circuits and voltage equations.
17. Discuss the differential compound generator with neat diagram
18. Discuss the cumulative compound generator with neat diagram
19. Explain the term-Reactance voltage.
20. Explain with sketch EMF commutation

Unit -2

Cognitive Level: UNDERSTAND

21. State and draw the O.C.C. of separately excited D.C. generator
22. Explain the process of voltage build up of a DC shunt generator.
23. State the conditions to build up the voltage in a shunt generator.
24. List the causes for the failure of voltage build up in a D.C shunt generator.
25. State the condition for maximum efficiency.

26. Define voltage regulation.

Cognitive Level: APPLICATION

27. Draw the External Characteristics of separately excited D.C. generator
28. Draw the Internal Characteristics of separately excited D.C. generator
29. Draw the O.C.C. of a D.C. shunt generator and determine the critical field resistance.
30. List the applications of series generator
31. List the applications of shunt generator
32. List the applications of compound generator

Unit- 3

Cognitive Level: REMEMBER

33. Define torque, Write expressions for shaft Torque, Armature Torque
34. Explain the torque-speed characteristic of shunt, series and compound motors.
35. State the applications of series motor.
36. State the applications of shun t motor.
37. State the applications of compound motor.
38. List Applications of shunt, series and compound motors.

Cognitive Level: UNDERSTAND

39. Describe the working Principle of D.C.Motors.
40. Compare the generator and motor action with neat sketches.
41. Illustrate the significance of back emf.
42. Classify D.C. motors and write their voltage equations.
43. Explain the speed-load characteristic of shunt, series and compound motors.
44. Explain the Torque-load characteristic of shunt, series and compound motors
45. List the advantages and dis-advantages of flux control over the armature control method
46. List the advantages and dis-advantages of armature control over flux control the method

Cognitive Level: APPLICATION

47. Explain speed control of shunt motor by Field control method.
48. Explain speed control of shunt motor by Armature resistance method.
49. Draw the Block diagram Electronic speed control of shunt motor.
50. Discuss the necessity of starter.
51. Explain the construction and operation of 3-point starter.
52. Draw the neat sketch of a 3-point starter and label the parts.
53. Demonstrate the functions of overload and no-volt relays.
54. Discuss why shunt motor is called constant speed motor?
55. Discuss why series motor is called variable speed motor?

Unit 4 - ALTERNATOR CONSTRUCTION AND WORKING

Cognitive Level: UNDERSTAND

56. Describe the basic principle alternator.
57. Describe the construction of salient type alternator.
58. Describe the construction of non-salient type alternator.
59. Distinguish between full pitch and fractional pitch windings
60. State the advantages and dis-advantages full pitch and fractional pitch windings.

Cognitive Level: APPLICATION

61. Compute the relation between P,N,f.
62. Derive an equation for emf generated in a 3-phase alternator.
63. A 3-phase, 16-pole alternator has a star-connected winding with 144 slots and10 conductors per slots. The flux per pole is 0.03 wb, sinusoidally distributed and the speed is 375rpm. Find the frequency rpm and the phase and line emf. Assume full-pitched coil.
64. Explain the armature reaction in an alternator with neat sketches.
65. Discuss the effects of leading p.f of load on armature reaction.
66. Discuss the effects of lagging p.f of load on armature reaction.
67. Discuss the effects of zero p.f of load on armature reaction.
68. Illustrate the effects of armature reaction on terminal voltage.

Unit-5ALTERNATORS PERFORMANCE

Cognitive Level: UNDERSTAND

69. Define effective resistance, leakage reactance & synchronous reactance.
70. Draw the vector diagram of alternator on load at different power factors
71. State the necessity and conditions for parallel operation of three alternators.
72. With a neat circuit diagram explain the parallel operation of three phase alternators using synchronoscope.
73. What do you mean by excitation? List the types of excitation.
74. Explain the effect of un-equal voltage on load sharing.
75. List different cooling agents.
76. List the merits of Hydrogen cooling
77. Explain hunting in alternators.

Cognitive Level: APPLICATION

78. Explain the procedure for conducting O.C & S.C. tests on alternator with circuit with Circuits.
79. Derive the equation for the no-load terminal voltage at different power factors.

80. Define regulation. List different methods to determine voltage regulation.
81. Explain EMF method of finding regulation of alternator.
82. Explain with neat circuit diagram the static excitation of an alternator.
83. Describe the effect of change in excitation on distribution of load
84. Describe the effect of change in excitation on prime mover input power on distribution of load
85. Explain how is Hunting Prevented in alternators?
86. Explain the necessity of cooling of alternators.

Unit-6

Cognitive Level: UNDERSTAND

87. Explain the construction and working of a universal motor.
88. Explain the construction and working of a Reluctance motor.
89. Explain the construction and working of a stepper motor.
90. Explain the construction and working of a servo motor.
91. Explain the construction and working of a brushless DC motor.
92. State the applications of universal motor.
93. State the applications of Reluctance motor.
94. State the applications of stepper motor.
95. State the applications of a servo motor.
96. State the applications of a brushless DC motor