INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRICAL AND ELECTRONICS ENGINEERING

ASSIGNMENT

Course Name	**:**	**Electrical Machines - I**
Course Code	**:**	**A30206**
Class	**:**	**II B. Tech I Sem**
Branch	**:**	**EEE**
Year	**:**	**2016 - 2017**
Course Faculty	**:**	Mr. K. Devender Reddy, Assistant Professor

OBJECTIVE:

Electrical machines course in one of the important courses of the Electrical discipline. In this course the different types of DC generators and motors which are widely used in industry are covered and their performance aspects will be studied.

S. No	Question	Blooms Taxonomy Level	Course Outcome
	UNIT - I **ELECTROMECHANICAL ENERGY CONVERSION**		
	Part – A (Short Answer Questions)		
1	Write the expressions of energy stored in capacitor	Remember	1
2	Define Fleming's right hand rule	Understand	1
3	On what factors, the EMF induced in a coil rotating in a magnetic field is depending?	Remember	2
4	Define the terms torque and force.	Remember	2
5	Give an expression for the energy density in an electric field.	Remember	2
6	Why energy storing capacity of electric field is much smaller than that of magnetic field?	Understand	1
7	What kind of EMF (either dc or ac) is induced in a rotating coil of DC generator?	Understand	1
8	Mention the advantages of analyzing energy conversion devices by field – energy concept?	Remember	2
9	Draw the linear response of flux linkage VS current (Ψ – I) for mechanical work – done during transient movement of armature.	Understand	1
10	Predominant energy storage does not occur in the air – gap of an electromechanical energy conversion device. Is this statement correct? Give reason in support of your answer.	Understand	1
11	Define Fleming's Left hand rule?	Understand	1
12	Define energy balance equation?	Remember	2
13	Define Self induced EMF?	Understand	1
14	Define mutual induced EMF?	Understand	1
15	Write the expressions of energy stored in Inductor.	Remember	1
	Part – B (Long Answer Questions)		
1	Draw and explain schematic diagram of flow of energy in the conversion of electrical energy into mechanical term.	Understand	1
2	With a neat schematic of electromagnetic system derive the expression for the energy absorbed by establishing flux linkages Ψ.	Remember	2
3	How the force between two parallel faces in a singly excited system calculated?	Understand	1
4	The typical saturation level flux density of a given ferromagnetic material is 1.4 T. Find the force density on iron face.	Evaluate	2
5	Derive the expression of torque developed in doubly excited magnetic system?	Remember	2

6	Discuss in brief about interaction torques.	Understand	1
7	Briefly write and explain the energy balance equation of a motor.	Remember	2
8	Distinguish between the terms “energy” and “co energy”	Understand	1
9	Mention the examples of singly – excited electromechanical energy conversion devices.	Remember	2
10	When the armature of an electromagnetic relay moves to close the air gap instantaneously, where does the energy come from for doing mechanical work?	Apply	1
11	Mention the examples of doubly – excited electromechanical energy conversion devices.	Remember	2
12	Discuss in brief about reluctance torques	Understand	1
13	Draw and explain schematic diagram of flow of energy in the conversion of Mechanical energy into electrical energy.	Understand	1
14	Explain the mechanical work done in singly excited system?	Remember	2
15	Explain the Stored field energy in singly excited system?	Understand	1
UNIT - II D.C. GENERATORS & ARMATURE REACTION			
Part – A (Short Answer Questions)			
1	What is the necessity of laminating the armature core of a DC generator?	Understand	3
2	What do you mean by “back E M F” in DC Machine?	Understand	3
3	Mention the types of armature winding and their specifications.	Remember	4
4	Why electromagnets are preferred other than permanent magnets in large DC machines?	Understand	3
5	Mention the reasons, why armature of a DC machine is made of laminated silicon steel?	Understand	4
6	Write the basic equation of induced E M F in DC Generator.	Remember	3
7	For which kind of machines lap winding is preferred?	Understands	4
8	Define commutation Process in DC generators?	Remember	3
9	What is the main function of compensating winding?	Remember	4
10	What is the use of equalizer rings?	Understand	4
11	Explain the necessity of inter poles	Remember	3
12	What is the use of laminations in armature?	Understands	4
13	Explain the principle of simple loop generator?	Understands	4
14	Compare Lap and Wave windings.	Remember	3
15	Explain the different type of brushes?	Understand	3
Part – B (Long Answer Questions)			
1	Explain in detail how direct quantity is obtained as an output in dc generator with the help of neat sketches?	Understand	3
2	What is the effect of armature reaction at leading and trailing pole tips of a dc generator? Explain with the help of neat sketches. b) Discuss the methods to minimize the effect of armature reaction in brief.	Understand	4
3	Describe the construction of DC machine with neat diagram and also derive the EMF equation of DC generator from its first principle.	Remembre	3
4	Define armature reaction & state its effect. b) What is back EMF? State its significance	Understand	4
5	Explain the principle of operation in dc generator with neat sketches.	Remember	3
6	Derive the expression for cross magnetizing effect of dc generator.	Remember	4
7	Derive the expression for de-magnetizing effect of dc generator.	Remember	4
8	Explain the commutation process in dc generator?	Understand	4
9	Explain the types of windings with applications?	Understand	3
10	Compare lap and wave winding at least in 8 aspects.	Remember	3
11	Explain the commutation improving methods?	Understand	4
12	Explain the following? Lap winding Wave winding	Remember	3

	Pole pitch Coil span		
13	Explain the importance of equalizer rings in DC generator with examples	Understand	4
14	A d.c. generator generates an E M F of 450 V and has 1000 armature conductors, flux per pole of 0.012 wb, speed of 1500 rpm and the armature winding has four parallel paths. Find the number of poles	Apply	3
15	A d.c. generator generates an E M F of 220 V and has 500 armature conductors, flux per pole of 0.014 wb, speed of 1800 rpm and the armature winding has four parallel paths. Find the number of poles	Apply	3
	UNIT – III **TYPES OF D.C GENERATORS & LOAD CHARACTERISTICS**		
	Part – A (Short Answer Questions)		
1	Mention the three important characteristics of a DC generator.	Understand	5
2	What are magnetic saturation and residual magnetism in DC generators?	Remember	5
3	Draw the external characteristics of series wound DC generator.	Understand	6
4	A 1500 kw, 600V, 16-pole separately excited DC generator runs at 200 RPM. It has 2,500 lap connected conductors and full – load. Copper losses are 25 KW. Calculate the useful flux per pole.	Evaluate	5
5	What is meant by OCC of a DC generator and explain?	Analyze	6
6	In a DC generator, if the load increase the flux per pole decreases. Justify the statement.	Analyze	5
7	Compare separately excited DC generator with self excited DC generator.	Remember	5
8	Compare self and separately excited DC machines.	Understand	5
9	A 4-pole, 15KW, 240V DC machine is wave connected. If this machine is now lap connected, all other things remain the same, calculate the voltage and current ratings of machine.	Evaluate	5
10	What is the importance of critical field resistance?	Understand	5
11	Explain the causes for non buildup of E M F in Dc generator	Analyze	5
12	What are the remedies for non buildup of E M F in Dc generator	Understand	5
13	Explain the pole flashing technique	Understand	5
14	A 6-pole, 20KW, 220V DC machine is wave connected. If this machine is now lap connected, all other things remain the same, calculate the voltage and current ratings of machine.	Evaluate	4
15	Explain about long shunt dc compound generator	Understand	5
	Part – B (Long Answer Questions)		
1	Explain the condition of non building up of E M F. in generator and also explain the remedies.	Understand	5
2	What are the different types of self-excited dc generators?	Remember	5
3	Draw and explain the load characteristics of a separately-excited dc generator.	Analyze	5
4	Explain the no load characteristics of dc series and shunt generators?	Understand	5
5	Explain the no load characteristics of dc compound generators?	Understand	5
6	Explain the parallel operation and conditions for parallel operation?	Understand	5
7	Explain the load characteristics of dc shunt and series generator?	Understand	5
8	Explain the load characteristics of dc compound generators?	Understand	5
9	Explain the purpose of using equalizing bars in parallel operation?	Analyze	6
10	Derive the terminal voltage and current expressions for the self and separately excited dc generators.	Remember	5
11	Explain the no load characteristics of dc shunt and shunt generators?	Understand	5
12	Explain about cumulatively and differentially compound dc generators?	Remember	5
13	Derive the terminal voltage and current expressions for the shunt and separately excited dc generators.	Remember	5
14	Derive the terminal voltage and current expressions for the series and short shunt compound wound dc generators.	Remember	4
15	Derive the terminal voltage and current expressions for the long shunt compound dc generators.	Remember	5

UNIT - 1V **D.C. MOTORS & SPEED CONTROL METHODS**			
Part – A (Short Answer Questions)			
1	Would you list out the types of DC generators based on field connections?	Remember	7
2	Write the expression for speed of DC motor in terms of number of conductors, supply voltage and armature current?	Apply	8
3	Show that, armature torque developed by motor is proportional to number poles and armature current.	Apply	7
4	Define shaft torque and Brake Horse Power.	Remember	7
5	How can determine the direction of rotation of a DC motor? And also explain how to change the direction of rotation?	Analyze	7
6	Explain why the EMF generated in the armature of a DC motor is called the "back emf".	Apply	7
7	What is a starter? Mention different types of starters for DC motor.	Remember	10
8	Draw the block diagram / circuit diagram of ward Leonard system and mention its applications.	Understand	9
9	On which factors speed of DC motor is depend?	Understand	8
10	Would you list out the applications series and compound motors?	Apply	7
11	Explain the necessity of starters	Understand	8
12	Compare 3 point and 4 point starters	Remember	10
13	Explain the torque	Remember	10
14	Derive the expression for Back E M F in DC Motors	Understand	8
15	Explain the Fleming left hand rule	Remember	10
Part – B (Long Answer Questions)			
1	With the help of speed torque characteristics, explain the motoring function of DC compound motor.	Understand & Remember	9
2	Explain the principle of operation of dc motor with neat sketch.	Understand	7
3	Derive the expression for torque in dc motor.	Remember	7
4	Derive the terminal voltage and current expressions for the self and separately excited dc motors.	Apply	7
5	Explain the applications of self and separately excited dc motors.	Understand	7
6	Explain the following speed control methods. a) Armature control b) flux control	Understand	8
7	Explain the Ward-Leonard system of speed control.	Remember	8
8	Explain the principle of operation of 3- point starter.	Understand	10
9	Explain the principle of operation of 4- point starter.	Understand	10
10	Explain the necessity of starters in dc machine and compare the 3-point and 4-point starters.	Understand	10
11	Which type of speed control techniques used in DC motor? Explain each one of them.	Understand	9
12	Explain the different types of Speed control methods	Remember	8
13	Briefly explain the Performance characteristics of DC shunt motor.	Understand	9
14	Briefly explain the Performance characteristics of DC series motor.	Understand	9
15	Briefly explain the Performance characteristics of DC compound motor.	Understand	9
UNIT - V **Testing of D.C. Machines**			
Part – A (Short Answer Questions)			
1	Mention the various losses that occur in DC machines?	Remember	9
2	Write down mechanical efficiency and electrical efficiency expressions in terms of Eg & I_a, for DC generator?	Understand	9
3	What is the condition for maximum efficiency of any DC machine?	Analyze	9
4	What do you understand by Swinburne's test and what are its limitations?	Understand	9
5	On which factors Eddy current and Hysteresis losses are depends?	Understand	9
6	Does core loss occur in armature or in the poles of DC machine?	Understand	9
7	Which type of mechanical losses occurs in a DC machine?	Remember	9
8	If P_C and P_S is the full – load copper loss and stray power losses (including iron		9

	loss) of DC machine for which value of the ratio P_C/P_S will be the maximum efficiency occur at 80% of full – load?	Apply	
9	Briefly explain with reason whether the field test on two identical DC series machines in generative method?	Understand	9
10	At which point of a conductor embedded in a slot does the maximum temperature occur?	Understand	9
11	Explain briefly about the Hopkinson's test?	Understand	9
12	Explain briefly about the Retardation test?	Remember	9
13	Explain briefly about the Separation of losses test?	Understand	9
14	Derive the expression for condition for maximum efficiency.	Understand	9
15	Classify the methods of testing?	Remember	9
Part – B (Long Answer Questions)			
1	Explain the experimental procedure to conduct 'Retardation Test' on a dc shunt machine with the help of connection diagram. How the different losses are estimated from the test results?	Understand	9
2	With neat circuit diagram, explain the procedure to conduct Swinburne's test.	Remember	9
3	Derive the expression for condition for maximum efficiency.	Understand	9
4	Explain how many losses are there in dc machine with equations.	Remember	9
5	Explain the procedure to conduct Hopkinson's test with neat sketches.	Understand	9
6	Explain the procedure separate the losses in dc machine with neat sketches.	Remember	9
7	Classify the methods of testing? And compare them.	Remember	9
8	Indirect test is superior to the direct test justify this statement with proof.	Analyze	9
9	With neat circuit diagram Calculate the efficiency by break test.	Apply	9
10	Draw and explain the internal l characteristics of dc shunt motor.	Understand	9
11	Draw and explain the external characteristics of dc shunt motor.	Understand	9
12	List the calculations to be made to predetermine the efficiency of DC motor by using Swinburne's test results.	Remember	9
13	Draw and explain the external characteristics of dc Series motor.	Understand	9
14	Draw and explain the external characteristics of dc Series motor.	Understand	9
15	Draw and explain the external characteristics of dc compound motor.	Understand	9

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