Hall Ticket No: | | | | | | | | | | |

Question Paper Code: AEEB11

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER

B.Tech III Semester End Examinations (Regular), November – 2019

Regulation: IARE–R18

ELECTRICAL MACHINES – I

(Electrical and Electronics Engineering)

Time: 3 hours **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1	a)	Draw and explain the general block diagram representation of an electromechanical energy con- version device.	[7M]
	b)	An inductor of resistance 4 ohm and inductance 2H is switched on to a voltage source which varies linearly from zero to 8 V in 2 sec and stays constant. Find energy stored in inductor (i) During the 2 sec period (ii) After all the transients are over.	[7M]
2	a)	Derive the expression for magnetic force and torque produced in a doubly excited magnetic field system.	[7M]
	b)	Explain the energy and forces in a multi excited magnetic field systems with necessary assumption.	[7M]

UNIT – II

3	a)	Derive an expression for induced EMF in a D.C. Generator.	[7M]
	b)	In a 120 V compound generator, the resistances of the armature shunt and series winding are 0.06 Ω, 25 Ω and 0.04 Ω respectively. The load current is 100 A at 120V. Find the induced EMF and the armature current when the machine is connected as i) Long shunt and as ii) Short shunt. Neglect brush contact drop and ignore armature reaction.	[7M]
4	a)	What is armature reaction? What are the effects of armature reaction? How the armature reaction is minimized?	[7M]
	b)	Two shunt generators, each with a no-load voltage of 125 V are running parallel. Their external characteristics can be taken as straight lines over their operating ranges. Generator No. 1 is rated at 25 kW and its full load voltage is 119 V, generator No. 2 is rated at 200 kW at 116 V. Calculate the bus bar voltage when the total load is 3500 A. How is the load divided between the two?	[7M]

UNIT – III

5 a) Explain with a neat sketch, how speed control of a DC. shunt motor can be achieved by Ward Leonard control system. [7M]

b) A 220 V DC series motor is running at a speed of 800 rpm and draws 100 A. Calculate at what speed the motor will run when developing half the torque. Total resistance of the armature and field is 0.1 ohm. Assume that the magnetic circuit is unsaturated. [7M]

6 a) Explain the Hopkinson's test to determine efficiency of dc machines. [7M]

b) A 4 Pole dc series motor has flux per pole is 4 10−3 Ia wb where Ia is the armature current. The motor drives a fan requiring 40 Nm at 1000 rpm. The wave connected armature has 480 conductors and its resistance is 1 ohm. Determine armature current and motor speed if it is fed from 230 v DC mains. [7M]

UNIT – IV

7 a) Draw and explain the phasor diagrams of a power transformer under full load lagging and leading power factor conditions. [7M]

b) The voltage per turn of a single phase transformer is 1.1 V. When the primary winding is connected to a 220V, 50 Hz AC supply, the secondary voltage is found to be 500V. Find [7M]

(i) Primary and secondary turns

(ii) Core area if the maximum flux density is 1.1 T.

8 a) What is Sumpner's test? Draw a circuit diagram to conduct this test and explain its principle [7M]

b) The following test results were obtained in a 250/500V transformer. [7M]

OC test (LV side) : 250V, 1A, 80W
SC test (HV side) : 20V, 12A, 100W
Determine (i) the circuit constants
(ii) The efficiency when the output is 10A at 500V and 0.8 power factor lagging.

UNIT – V

9 a) With neat circuit and phasor diagrams, explain the operation of Y-Y and Y-Δ connections [7M]

b) Two transformers connected in open delta supply a 400 KVA balanced load operating at 0.866 p.f (lag). The load voltage is 440 V. What is the [7M]

i) KVA supplied by each transformer

ii) KW supplied by each transformer

10 a) What are the advantages and disadvantages of auto transformer over two winding transformer. [7M]

b) Two Scott connected transformers are used to supply a balanced load of 100 KVA at 400 V from a balanced 11 KV 3 phase supply. Determine [7M]

i) Current and voltage rating of each transformer coil

ii) KVA rating of the main and teaser transformers.

INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)

COURSE OBJECTIVES:
The course should enable the students to:

I	Understand the concepts of magnetic circuits and illustrate the theory of electromechanical energy conversion and the concept of co-energy
II	Understand the operation of DC machines
III	Analyze the differences in operation of different DC machine configuration
IV	Analyze single phase and three phase transformers circuits

COURSE OUTCOMES (COs):

I	Describe the basic concepts of electro-mechanical energy conversion, energy balance, energy stored in magnetic field, co-energy, single and multi excited systems
II	Discuss the working principle, losses, efficiency, characteristics and various tests of DC generator.
III	Analyze the working principle, losses, efficiency, characteristics and various tests of DC motor.
IV	Describe the working principle, EMF equation, phasor diagram, losses, efficiency, regulation, characteristics and various tests of single phase transformer.
V	Analyze the working principle, various connections of three phase transformer. Auto transformer, Scott connection, on load and off load tap changing transformer, cooling methods.

COURSE LEARNING OUTCOMES:
Students, who complete the course, will have demonstrated the ability to do the following:

AEEB11.01	Describe the basic electromagnetic energy conversion process, energy storage and energy balance.
AEEB11.02	Solve simple and complex problems related to electromagnetic circuits.
AEEB11.03	Derive the force and torque produced in singly excited, multi excited magnetic systems.
AEEB11.04	Outline the construction, operation, windings used, concept of armature reaction, commutation and types of DC generators.
AEEB11.05	Discuss the characteristics, losses, regulation, efficiency, characteristics and applications of DC generators.
AEEB11.06	Examine the parallel operation of DC generators, importance of equalizer bars and load sharing
AEEB11.07	Study the operation, construction, significance of back EMF, torque, characteristics and speed control methods of DC motors.
AEEB11.08	Classify the different types of losses, condition for maximum power and efficiency and starters used for DC motors.
AEEB11.09	Determine the efficiency of DC machines by conducting direct and indirect tests.
AEEB11.10	Discuss the principles of operation, construction, types, EMF equation and equivalent circuit of single phase transformers.
AEEB11.11	Explain the operation of single phase transformer under no-load and on-load along with its phasor diagrams.
AEEB11.12	Calculate the efficiency and regulation of single phase transformers by conducting different tests.
AEEB11.13	Examine the parallel operation of single phase transformers and analyze the load sharing.
AEEB11.14	Explain the operation, construction and different types of connections of three phase transformers.

AEEB11.15	Demonstrate the operation of open delta connection and Scott connection with two single phase transformers and tap changing transformer.
AEEB11.16	Explain the functioning of autotransformers, tap changing transformers and off-load, on-load tap changers.
AEEB11.17	Explore the knowledge and skills of employability to succeed in national and international level competitive examinations

MAPPING OF MODEL QUESTION PAPER QUESTIONS TO THE ACHIEVEMENT OF COURSE OUTCOMES

SEE QUESTION No.		COURSE LEARNING OUTCOMES		Course Outcomes	BLOOM TAXONOMY LEVEL
1	a	AEEB11.02	Solve simple and complex problems related to electromagnetic circuits	CO 1	Remember
	b	CEE004.01	Describe the basic electromagnetic energy conversion process, energy storage and energy balance.	CO 1	Understand
2	a	AEEB11.03	Derive the force and torque produced in singly excited, multi excited magnetic systems.	CO 1	Understand
	b	AEEB11.03	Derive the force and torque produced in singly excited, multi excited magnetic systems.	CO 1	Understand
3	a	AEEB11.04	Outline the construction, operation, windings used, concept of armature reaction, commutation and types of DC generators.	CO 2	Remember
	b	AEEB11.04	Outline the construction, operation, windings used, concept of armature reaction, commutation and types of DC generators.	CO 2	Understand
4	a	AEEB11.05	Discuss the characteristics, losses, regulation, efficiency, characteristics and applications of DC generators.	CO 2	Understand
	b	AEEB11.06	Examine the parallel operation of DC generators, importance of equalizer bars and load sharing	CO 2	Understand
5	a	AEEB11.07	Study the operation, construction, significance of back EMF, torque, characteristics and speed control methods of DC motors.	CO 3	Remember
	b	AEEB11.08	Classify the different types of losses, condition for maximum power and efficiency and starters used for DC motors.	CO 3	Understand
6	a	AEEB11.09	Determine the efficiency of DC machines by conducting direct and indirect tests.	CO 3	Understand
	b	AEEB11.08	Classify the different types of losses, condition for maximum power and efficiency and starters used for DC motors.	CO 3	Understand
7	a	AEEB11.11	Explain the operation of single phase transformer under no-load and on-load along with its phasor diagrams.	CO 4	Understand
	b	AEEB11.10	Discuss the principles of operation, construction, types, EMF equation and equivalent circuit of single phase transformers	CO 4	Understand
8	a	AEEB11.12	Calculate the efficiency and regulation of single phase transformers by conducting different tests.	CO 4	Understand
	b	AEEB11.12	Calculate the efficiency and regulation of single phase transformers by conducting different tests.	CO 4	Remember
9	a	AEEB11.15	Demonstrate the operation of open delta connection and Scott connection with two single phase transformers and tap changing transformer.	CO 5	Understand
	b	AEEB11.15	Demonstrate the operation of open delta connection and Scott connection with two single phase transformers and tap changing transformer.	CO 5	Understand

10	**a**	**AEEB11.16**	Explain the functioning of autotransformers, tap changing transformers and off-load, on-load tap changers.	CO 5	Understand
	b	**AEEB11.15**	Demonstrate the operation of open delta connection and Scott connection with two single phase transformers and tap changing transformer.	CO 5	Understand

Signature of Course Coordinator **HOD, EEE**