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

Question Paper Code: AEEB15

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER

B.Tech IV Semester End Examinations (Regular), May – 2020

Regulation: IARE–R18

ELECTRICAL MACHINES - II

(Electrical and Electronics Engineering)

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

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

MODULE – I

1	a)	Explain the operation of magnetic field produced in windings by alternating current	**[7M]**
	b)	Demonstrate the magnetic field produced by spatial displacement of windings	**[7M]**
2	a)	Describe the process of magnetic field produced by single winding	**[7M]**
	b)	Demonstrate the process of magnetic field produced by fixed current	**[7M]**

MODULE – II

3	a)	Make a list of methods used for starting the squirrel cage and slip ring induction motors, also explain any one method of starting each motor.	**[7M]**
	b)	A 4 pole, 50 Hz, wound rotor IM has a rotor resistance of 0.56 ph and runs at 1430 rpm at full load. Calculate the additional resistance per phase to be inserted in the rotor circuit to lower the speed to 1200 rpm, if the torque remains constant.	**[7M]**
4	a)	Explain the principle of operation and characteristics of induction generator with a list of few applications.	**[7M]**
	b)	A 14.9 kW, 400V, three phase induction motor gave the following test readings: No load test: 400V, 1250W, 9A Short circuit test: 150V, 4 kW, 38 A Determine the value of full load current, power factor and slip from the circle diagram.	**[7M]**

MODULE – III

5 a) Describe the construction and operation of alternator and also derive the EMF equation. **[7M]**

b) The stator of a 3-phase, 20-pole alternator has 120 slots and there are 4 conductors per slot accommodated in two layers. If the speed of the alternator is 300rpm, calculate the EMF induced per phase. Resultant flux in the air-gap is 0.05 wb per pole. Assume the coil span as 1600 electrical. **[7M]**

6 a) Define synchronization and explain different methods for synchronizing the alternator to the supply grid. **[7M]**

b) A 3-phase star-connected synchronous generator is rated at 1.4MVA, 11KV. The armature effective resistance and synchronous reactance are 1.2 Ω and 25Ω respectively per phase. Calculate the percentage voltage regulation for a load of 1.4375MVA at (i) 0.8pf lagging and (ii) 0.8 p.f leading. Also find out the p.f at which the regulation becomes zero. **[7M]**

MODULE – IV

7 a) Discuss with phasor diagrams the behavior of synchronous motor with constant field excitation and variable load. **[7M]**

b) A 500V, 6-pole, 3-phase, 50hz, star-connected synchronous motor has a resistance and synchronous reactance of 0.3Ω and 3Ω per phase respectively. The open-circuit voltage is 600v. If the friction and core losses total 1kw,calculate the line current and power factor when the motor output is 100hp. **[7M]**

8 a) Derive the expression for power developed in a synchronous motor, various conditions for maximum power developed **[7M]**

b) A 76 KW 3phase Y- connected, 50Hz, 415V cylindrical rotor synchronous motor operates at rated condition with 0.8pf leading. The motor efficiency excluding field and stator losses, is 96% and Xs=2.55Ωcalculate (i) mechanical power developed (ii) armature current (iii) back EMF (iv) power angle and (v)max or pull out toque of the motor. **[7M]**

MODULE – V

9 a) Explain why a single phase induction motor is not self staring and how it can be made a self starting motor? **[7M]**

b) Find the mechanical power output of 185kw, 4 pole, 110V, 50Hz single phase induction motor, whose constants are given below at a slip of 0.05. R1=1.86Ω, X1=2.56 Ω, Xϕ=53.5 Ω, R2=3.56 Ω X2=2.56 Ω core loss 3.5w, friction and wind age loss 13.5w **[7M]**

10 a) Explain the construction and working of split phase and shaded pole motors, also mention some of its applications. **[7M]**

b) A 230 V, 380 W, 50 Hz, 4 pole, single phase induction motor gave the following test results: **[7M]**

No load test: 230 V, 84 W, 2.8 A
Blocked rotor test: 110 V, 460 W, 6.2 A
The stator winding resistance is 4.6 Ω and during the blocked rotor test, the auxiliary winding is open. Determine the equivalent circuit parameters.

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COURSE OBJECTIVES:

The course should enable the students to:

I	Discuss the construction, working and characteristics of three phase induction motor and synchronous motor
II	Illustrate the equivalent circuit and speed control methods of three phase induction motors.
III	Outline the working and parallel operation of alternators.
IV	Evaluate synchronous impedance and voltage regulation of synchronous machine.

COURSE OUTCOMES (COs):

CO1	Analyze constant, pulsating and revolving magnetic fields
CO2	Describe the operation and performance of three phase induction motors
CO3	Understand the operation and performance characteristics of synchronous generator
CO4	Demonstrate the construction and operation of synchronous motor
CO5	Understand the construction, starting methods and torque speed characteristics of various single phase induction motors

COURSE LEARNING OUTCOMES (CLOs):

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

AEEB15.01	Understand the concept of constant magnetic fields
AEEB15.02	Analyze pulsating fields produced by spatially displaced windings
AEEB15.03	Describe revolving magnetic fields
AEEB15.04	Understand the principle of operation, constructional features different types of torques, various losses, efficiency and torque- slip characteristics of three phase induction motor
AEEB15.05	Describe no -load and blocked rotor test of three phase induction motor for calculating the equivalent circuit parameters and circle diagram
AEEB15.06	Understand the starting and speed control methods of three phase induction motor, induction generator and doubly-fed Induction machines
AEEB15.07	Understand the principle of operation and constructional features and different types of armature windings of synchronous alternator
AEEB15.08	Understand the phasor diagrams of alternator on no-load, load and analyze the harmonics and its suppression methods.
AEEB15.09	Describe the different methods for calculating the voltage regulation, parallel operation and slip test
AEEB15.10	Understand the principle of operation, constructional features and starting methods of synchronous motor
AEEB15.11	Describe the importance of power, excitation circles and effect of varying different parameters on synchronous motor performance

AEEB15.12	Understand the concept of constructing V, inverted V curves and synchronous condenser
AEEB15.13	Understand double revolving, cross field theory and the principle of operation and constructional features of single phase induction motor
AEEB15.14	Describe the starting methods of single phase induction motor
AEEB15.15	Describe the torque-speed characteristics of single phase induction motor and equivalent circuit.
AEEB15.16	Apply the concept of electromagnetic and electrostatic fields to solve real time world applications.
AEEB15.17	Explore the knowledge and skills of employability to succeed in national and international level competitive examinations.

MAPPING OF SEMESTER END EXAMINATION QUESTIONS COURSE LEARNING OUTCOMES:

SEE QUESTION No.		COURSE LEARNING OUTCOMES		CO	BLOOM TAXONOMY LEVEL
1	a	AEEB15.01	Understand the concept of constant magnetic fields	CO1	Understand
	b	AEEB15.01	Analyze pulsating fields produced by spatially displaced windings	CO1	Remember
2	a	AEEB15.03	Understand the different types of torques and torque- slip characteristics	CO1	Understand
	b	AEEB15.04	Describe no -load and blocked rotor test of three phase induction motor	CO1	Understand
3	a	AEEB15.05	Understand the speed control methods of three phase induction motor	CO2	Remember
	b	AEEB15.02	Understand production of torque and modes of three phase induction motor operation	CO2	Understand
4	a	AEEB15.06	Describe circle diagram of three phase induction motor and concept of induction generator	CO2	Understand
	b	AEEB15.06	Describe circle diagram of three phase induction motor and concept of induction generator	CO2	Understand
5	a	AEEB15.07	Understand the principle of operation and constructional features of synchronous alternator	CO3	Remember
	b	AEEB15.08	Describe the different methods of armature winding of synchronous alternator and analyze the phasor diagrams of alternator on no-load and load	CO3	Understand
6	a	AEEB15.09	Understand the concept of Parallel operation and slip test	CO3	Understand
	b	AEEB15.10	Understand the concept of Parallel operation and slip test	CO3	Understand
7	a	AEEB15.12	Describe the importance of power, excitation circles and effect of varying different parameters on synchronous motor performance	CO4	Understand
	b	AEEB15.12	Describe the importance of power, excitation circles and effect of varying different parameters on synchronous motor performance	CO4	Understand
8	a	AEEB15.12	Describe the importance of power, excitation circles and effect of varying different parameters on synchronous motor performance	CO4	Understand
	b	AEEB15.12	Describe the importance of power, excitation circles and effect of varying different parameters on synchronous motor performance	CO4	Remember

9	**a**	**AEEB15.14**	Understand the principle of operation and constructional features of single phase induction motor and Starting methods for single phase induction motor	CO5	Understand
	b	**AEEB15.15**	Understand the principle of operation and constructional features of single phase induction motor and Starting methods for single phase induction motor	CO5	Understand
10	**a**	**AEEB15.14**	Understand the principle of operation and constructional features of single phase induction motor and Starting methods for single phase induction motor	CO5	Understand
	b	**AEEB15.15**	Describe the torque-speed characteristics of single phase induction motor and equivalent circuit.	CO5	Understand

Signature of Course Coordinator **HOD, EEE**