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 process of pulsating magnetic fields produced by spatial displaced windings	**[7M]**
	b)	Explain the process of pulsating magnetic fields produced by spatially shifted by 90^0 windings	**[7M]**
2	a)	Explain the process of addition of pulsating magnetic fields	**[7M]**
	b)	Demonstrate the process of magnetic field produced by three windings spatially shifted by 120^0	**[7M]**

MODULE – II

3	a)	Describe the principle operation and constructional features of three phase induction motor.	**[7M]**
	b)	The frequency of stator EMF is 50 Hz for an 8-pole three phase induction motor. If the rotor frequency is 2.5 Hz, calculate the slip and the actual speed of rotor.	**[7M]**
4	a)	Derive the torque equation of an induction motor. Mention the condition for maximum torque.	**[7M]**
	b)	An 8 pole, three phase alternator is coupled to a prime mover running at 750 rpm. It supplies an induction motor which has a full load speed of 960 rpm. Find the number of poles of induction motor and slip.	**[7M]**

MODULE – III

5 a) Explain the working principle and derive EMF equation of an alternator. **[7M]**

b) Calculate the speed and open-circuit line and phase voltages of a 4-pole, 3-phase, 50hz star-connected alternator with 36 slots and 30 slots 30 conductors per slot. The flux per pole is 0.05wb. **[7M]**

6 a) Discuss the procedure for determination of synchronous reactance of an alternator. **[7M]**

b) A 4-ploe, 50hz star-connected alternator has a flux per pole of 0.12wb. It has 4 slots per pole per phase, conductors per slot being 4.if the winding coil span is 150^0, find the EMF. **[7M]**

MODULE – IV

7 a) Mention the various applications of synchronous motor and describe the functions of a damper winding in a synchronous motor **[7M]**

b) A 3-phase, 415V, 6-pole, 50hz, star-connected synchronous motor has EMF of 520V (L-L). the stator winding has a synchronous reactance of 2ohms per phase and the motor develops a torque of 220N-m.the motor is operating at 415V,50hz bus (a) calculate the current drawn from the supply and it's power factor (b) draw the phasor diagram showing all the relevant quantities. **[7M]**

8 a) Derive the expression for power developed in a synchronous motor, various conditions for maximum power developed. **[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 100 HP **[7M]**

MODULE – V

9 a) Explain the constructional features and principle of operation of a single phase induction motor **[7M]**

b) The following data pertains to a 230 V, 50 Hz capacitor start single phase induction motor at stand still. Main winding excited alone=100V, 2A, 40 W. Auxiliary winding excited alone= 80 V, 1 A, 50 W **[7M]**

Determine the value of capacitance for determining the maximum torque.

10 a) Using double revolving field theory explain the torque-slip characteristic of a single phase induction motor and prove that it cannot produce ant starting torque **[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. **[7M]**
R1=1.86 Ω, 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

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COURSE OBJECTIVES (COs):

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**