Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem Examination Dec 2024

RA3CO37 / RA3CO21

Electrical Machines & Power Systems

Programme: B.Tech. Branch/Specialisation: RA

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

			Marks	BL	PO	CO	PSO
Q.1	i.	The path of magnetic flux in a transformer should have: (a) High resistance (b) High reluctance (c) Low reluctance (c) Low resistance	**1**	1	1,4	1	1,2
	ii.	A transformer core is laminated to: (a) Reduce the hysteresis loss (b) Reduce the eddy current losses (c) Reduce copper losses (d) Reduce all the above losses	**1**	1	1,4	1	1,2
	iii.	Which of the following motor have highest No-load speed? (a) Shunt motor (b) Series motor (c) Cumulative compound motor (d) Differentiate compound motor	**1**	1	1,4	1	1,2
	iv.	The direction of rotation of a dc series motor can be changed by: (a) Interchanging supply terminals (b) Interchanging field terminals (c) Either of (a) and (b) (d) None of these	**1**	1	1,4	1	1,2

P.T.O.

v.	A 4-pole, 50 Hz induction motor runs at a speed of 1440 rpm. The frequency of rotor current is: (a) 3 Hz (b) 2.5 Hz (c) 2 Hz (d) 1 Hz	**1**	2	1,4	3	1,2
vi.	If N_s is the synchronous speed and s is the slip then the actual running speed of an induction motor will be: (a) N_s *(b) s N* (c) (1-s) N_s (d) (N_s-1) s	**1**	1	1,4	1	1,2
vii.	Which of the following motors have highest operating speed? (a) Stepper motor (b) Capacitor start motor (c) Brushless D.C. motor (d) Universal motor	**1**	1	1,4	1	1,2
viii.	Calculate the stepping angle for 3-phase, 24 pole permanent magnet stepper motor. (a) 1.8^o (b) 3.6^o (c) 5^o (d) 2.5^o	**1**	2	1,4	3	1,2
ix.	Which of the following is a primary source of energy in a nuclear power station? (a) Uranium (b) Lignite (c) Peat (d) Natural gas	**1**	1	1,4	1	1,2
x.	Which of the following voltage levels is used for the distribution of 3-phase power to domestic consumers? (a) 230 V (b) 415 V (c) 600 V (d) 765 V	**1**	1	1,4	1	1,2

Q.2	i.	What are the applications of an autotransformer?	**2**	1	1,4	1	1,2
	ii.	Derive the emf equation of transformer.	**3**	3	1,4	3	
	iii.	State and prove the condition for maximum efficiency of a single-phase transformer.	**5**	3	1,4	3	1,2

OR	iv.	Why are transformers needed in a power system? What are the distinguish features of three phase transformer?	**5**	3	1,4	2	1,2
Q.3	i.	Derive the induced emf equation of dc machine.	**3**	3	1,4	3	1,2
	ii.	Explain how the back emf of a dc motor causes the development of mechanical power.	**7**	3	1,4	2	1,2
OR	iii.	With a neat diagram explain the different characteristics of dc shunt motor.	**7**	3	1,4	4	1,2
Q.4	i.	Give the principle of operation of 3-phase induction motor.	**2**	3	1,4	2	1,2
	ii.	Why is a 1-phase induction motor not a self-started machine? Explain any two types of starting methods for 1-phase induction motor.	**8**	3	1,4	3	1,2
OR	iii.	Draw and explain the torque-slip characteristics of 3-phase induction motor, clearly showing the starting torque, maximum torque, and normal operating region.	**8**	3	1,4	4	1,2
Q.5	i.	Write down the merits and demerits of 2-phase servomotor.	**4**	1	1,4	2	1,2
	ii.	Write short notes on: (a) Variable reluctance stepper motor (b) Permanent magnet synchronous motor	**6**	3	1,4	5	1,2
OR	iii.	With a neat diagram explain the principle of operation of BLDC motor.	**6**	3	1,4	5	1,2
Q.6		Attempt any two:					
	i.	Describe a typical ac electric power supply system with the help of a single line diagram.	**5**	2	1,4	3	1,2
	ii.	Draw the schematic diagram of a nuclear power station and discuss its operation.	**5**	3	1,4	4	1,2
	iii.	Discuss the merits and demerits of a hydroelectric plant.	**5**	3	1,4	3	1,2

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Marking Scheme

RA3CO37 (T) Electrical Machines & Power Systems (T)

			Marks
Q.1	i.	(c) low reluctance.	**1**
	ii.	(b) reduce the eddy current losses.	**1**
	iii.	(b) Series motor.	**1**
	iv.	(b) Interchanging field terminals.	**1**
	v.	(c) 2 Hz	**1**
	vi.	(c) (1-s) N_s	**1**
	vii.	(c) Brushless D.C. motor	**1**
	viii.	(c) 5^o	**1**
	ix.	(a) Uranium	**1**
	x.	(b) 415 V	**1**
Q.2	i.	Each application equal to 1 mark…. 2 applications… 2 marks	**2**
	ii.	Derivation ……. equals to 3 marks	**3**
	iii.	Statement ……1 mark Derivation ……. …..4 marks	**5**
OR	iv.	Need of transformer……2 marks Features……...3 marks	**5**
Q.3	i.	Derivation ……. …..3 marks	**3**
	ii.	Concept…….3 marks Developed power……...4 marks	**7**
OR	iii.	Diagram…...….. 4 marks Explanation……3 marks	**7**
Q.4	i.	Principle of operation …….. 2 marks	**2**
	ii.	Reason ……2 marks Each method equal to 3 mark…. 2 methods… 6 marks	**8**
OR	iii.	Characteristic…… 4 marks Explanation …….. 4 marks	**8**
Q.5	i.	Each merit equal to 1 mark…. 2 merits… 2 marks Each demerit equal to 1 mark…. 2 demerits… 2 marks	**4**
	ii.	Each short note equal to 3 mark…. 2 short notes… 6 marks	**6**
OR	iii.	Diagram…...….. 3 marks Explanation……3 marks	**6**
Q.6		Attempt any two:	
	i.	Diagram…...….. 2 marks Explanation……3 marks	**5**
	ii.	Diagram…...….. 2 marks Explanation……3 marks	**5**
	iii.	Each merit equal to 1 mark…. 3 merits… 3 marks Each demerit equal to 1 mark…. 2 demerits… 2 marks Total merit & demerit mention then give 5 marks	**5**

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