Code No: R1621022 **R16** SET - 1

II B. Tech I Semester Regular Examinations, October/November - 2017
ELECTRICAL MACHINES – I
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any F**OUR** Questions from **Part-B**

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PART –A

1.	a)	What is a doubly-excited magnetic system? Mention two examples.	2M
	b)	What is the function of compensating winding?	2M
	c)	What are the drawbacks of field flux control method?	2M
	d)	What is meant by all day efficiency? When it is used	3M
	e)	Explain why in testing of large transformers the open-circuit test is carried out with the high-voltage winding open and the short-circuit test with the low-voltage winding shorted.	2M
	f)	What are the salient features of delta-star connected three-phase transformer?	3M

PART -B

2.	a)	Describe the process of voltage build up in self-excited generators.	7M
	b)	For a singly excited magnetic system, derive the expression for the magnetic energy stored in terms of reluctance.	7M
3.	a)	What are the losses that occur in dc machines? Derive the condition for maximum efficiency in a dc generator.	7M
	b)	A dc shunt motor is running at 1200 rpm and it has an armature resistance of 0.15 Ω. The current taken by the armature is 60 A when the applied voltage is 220 V. If the load is increased by 30%, find the variation in the speed.	7M
4.	a)	Explain with the help of a neat sketch the principle of operation of a four-point starter.	8M
	b)	A 240 V shunt motor has an armature resistance of 0.2 Ω and takes armature current of 20 A on full-load. The electromagnetic torque being constant, by how much must the flux be reduced to increase the speed by 40%?	6M
5.	a)	Distinguish between core-type and shell-type transformer. Why is the low-voltage winding placed near the core? Why is the core of a transformer laminated?	7M
	b)	A 50 kVA, 3.3 kV/230 V single-phase transformer has an impedance of 4.2% and a copper loss of 1.8% at full load. Calculate the ohmic value of resistance, reactance and impedance referred to the primary side. Estimate the primary short circuit current, assuming the supply voltage to be maintained at constant value.	7M
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6. a) Discuss about Sumpner's test on a single-phase transformer. 7M

   b) A 400/100 V, 5 kVA, single-phase two winding transformer is to be used as an auto-transformer to supply 400 V from a 500 V voltage source. When tested as a two winding transformer at rated load and 0.8 p.f. lagging, its efficiency was found to be 0.95. 7M
      (i) Determine its kVA rating as an Auto-transformer.
      (ii) Find its efficiency as an auto-transformer at rated load and at 0.8 p.f. lagging.

7. a) What is inrush phenomena in transformer? Discuss qualitatively this phenomena if single-phase transformer is switched on at the instant applied voltage is maximum positive. 7M

   b) Draw the connection diagrams and explain the features of Y-Y, Y-Δ, Δ-Y and Δ-Δ three-phase connections. 7M

Code No: R1621022 **R16** SET - 2

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ELECTRICAL MACHINES – I
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1.	a)	What is a singly-excited magnetic system? Mention two examples.	2M
	b)	Enumerate the various losses in a dc machine.	2M
	c)	Explain the function of no-volt release in a three-point starter.	2M
	d)	Why is the transformer core laminated?	3M
	e)	Why is it preferable to install two or more transformers in parallel than one large unit?	2M
	f)	Discuss whether the winding should be tapped on h.v. side or l.v. side.	3M

PART -B

2.	a)	Name the different parts of a dc machine and state the function of each part.	7M
	b)	A short-shunt dc compund generator supplies 150 A at 100 V. The resistance of armature, series field and shunt field windings are 0.04, 0.03 and 60 Ω respectively. Find the e.m.f generated. Also find the e.m.f generated if same machine is connected as a long shunt machine.	7M
3.	a)	Explain the function of compensating windings in dc machines.	7M
	b)	A 11 kW, 240 V shunt motor has an armature resistance of 0.5 Ω and a field resistance of 200 Ω. At no-load and rated voltage, the speed is 1250 rpm and the armature current is 3 A. At full-load and rated voltage, the line current is 48 A and because of armature reaction, the flux is 4% less than its no-load value. Determine the (i) developed torque at no-load (ii) full-load speed and (iii) developed torque at full-load.	7M
4.	a)	Explain with diagram how Hopkinson's test is performed on dc machines. What are the advantages and disadvantages of this test?	7M
	b)	An engine room ventilator fan series motor has a total resistance of 0.5 Ω and runs from a 110 V supply at 1000 rpm when the current is 28 A. What resistance in series with the motor will reduce the speed to 750 rpm? The load torque is proportional to the square of the speed and the field strength can be assumed to be proportional to the current.	7M
5.	a)	Define voltage regulation of a transformer. Derive an expression for voltage regulation under lagging p.f. load.	7M
	b)	A single-phase transformer supplies a load of 20 kVA at a p.f. of 0.8 (lagging). The iron loss of the transformer is 200 W and the copper losses at this load is 180 W. Calculate (i) the efficiency (ii) the new efficiency if the load is now changed to 30 kVA at a p.f. of 0.9 (lagging).	7M
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6. a) Explain why parallel operation of transformer is necessary. State the essential and desirable conditions which would be satisfied before two single-phase transformers may be operated in parallel. 7M

   b) The OC test (LV side) and SC test (HV side) results of a single-phase 6 kVA, 250/500 V transformer are 250 V, 1.2 A, 80 W and 25 V, 10 A, 95 W respectively. Determine the circuit parameters referred to LV side and also calculate the regulation and efficiency of the transformer at full-load and half-load at 0.5 p.f. lagging. 7M

7. a) What are the advantages of a single three-phase transformer over three single-phase transformer banks of the same kVA rating? State the difference between a three-phase transformer bank and a three-phase transformer unit. 7M

   b) Explain about on load and off load tap changers provided in a 3- phase transformers 7M

Code No: R1621022 **R16** SET - 3

II B. Tech I Semester Regular Examinations, October/November - 2017
ELECTRICAL MACHINES – I
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1.	a)	What are the conditions under which electro-magnetic torque will exist in a doubly-excited system?	2M
	b)	Why are interpoles designed to provide m.m.f. more than the armature m.m.f. in the commutating zone?	3M
	c)	What is the difference between 3-point and 4-point starter?	2M
	d)	Discuss how core flux in an ideal transformer is independent of load current.	2M
	e)	In Sumpner's test, the reading of the wattmeter recording the core losses, remains unaffected when low-voltage is injected in the secondary series circuit. Explain.	3M
	f)	What are the applications of open delta connection?	2M

PART -B

2.	a)	What are the different types of dc generators according to the ways in which field are excited? Show the connection diagram of each type.	7M
	b)	A 4-pole lap wound dc shunt generator has a useful flux per pole of 0.07Wb, the armature winding consists of 220 turns each of 0.004 Ω resistance. Calculate the terminal voltage when running at 900 r.p.m. and the armature current is 50 A.	7M
3.	a)	Explain the principle of torque production in a dc motor and derive an expression for it.	7M
	b)	A 15 kW, 230 V shunt generator having an armature resistance of 0.15 Ω and a field resistance of 230 Ω delivers full-load at rated voltage and 750 rpm. The machine is now run as a motor while taking 15 kW at 230 V. What is the speed of the motor? Neglect brush contact drop.	7M
4.	a)	Explain field control method for speed control of a dc shunt machine.	7M
	b)	A 250 V dc shunt motor has a field resistance of 200 Ω and an armature resistance of 0.8 Ω. It is operating at full-load, drawing an armature current 30 A and by inserting resistance in the field circuit, the speed is increased to 1200 rpm. If the load torque is linearly proportional to speed, find the value of external resistance in the field circuit.	7M
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5. a) Draw the exact equivalent circuit of a transformer and derive the equivalent circuits referred to primary and secondary. Describe the various parameters involved in it. 7M

   b) A 200 V/400V, 50 Hz transformer has peak flux density of 1.1 Wb/m^2 in the core and the net area of cross section of the core is 0.02 sqm. If the current density in the conductor is 3 A/mm^2 and conductor diameter of primary coil is 3 mm. Determine the kVA rating of the transformer and the number of primary and secondary turns. 7M

6. a) In an auto-transformer, the power transferred from primary to secondary circuit is partly by conduction and partly by induction. Explain. 6M

   b) A 10 kVA, 500/250 V, 50 Hz single-phase transformer gave the following test data: 8M

   OC Test (LV side): 250 V, 1.0 A, 80 W

   SC Test (HV side): 25 V, 12 A, 100 W

   Where LV refers to the low voltage and HV refers to high voltage side. Determine the following:

   (i) Equivalent circuit referred to LV side

   (ii) Secondary load voltage at 0.8 p.f. lagging with full-load current

7. a) Explain with the help of connection and phasor diagrams how a Scott connection is used to obtain two-phase supply from three-phase supply. 7M

   b) Why are tappings provided in transformers? Explain with the help of connection diagrams the operation of off-load tap changer. 7M

Code No: R1621022 **R16** SET - 4

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2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1.	a)	What is importance of field flashing and critical speed in a dc generator	2M
	b)	What are the two functions of a commutator in dc machines?	2M
	c)	For a dc motor, the field flux speed control method is called a constant power drive method. Explain.	2M
	d)	Distinguish between step-up and step-down transformers.	2M
	e)	Distinguish clearly the difference between a resistive potential divider and Auto-transformer.	2M
	f)	Mention any two applications of three-winding transformers.	2M

PART -B

2.	a)	Explain the principle of operation of a dc generator and derive its emf equation.	7M
	b)	Draw and explain fully the general block diagram representation of an electromechanical energy-conversion device.	7M
3.	a)	Draw and explain speed-torque and torque-current characteristics of (i) a dc shunt motor and (ii) a dc series motor.	7M
	b)	A 480 V, 20 kW shunt motor takes 2.5 A when running at no-load. Taking the armature resistance to be 0.6 Ω, field resistance to be 800 Ω and brush drop 2 V, find the full-load efficiency.	7M
4.	a)	Explain with diagram how retardation test is performed on dc machine.	7M
	b)	A 400 V dc shunt motor has an armature and shunt-filed resistance of 0.3 and 200 Ω respectively. It takes full-load current of 50 A and runs at 1000 rpm. Calculate the speed of the motor when a 100 Ω resistor is connected in series with the field winding, the load torque remaining same. Assume that field flux is proportional to the field current.	7M
5.	a)	Draw and explain the phasor diagram of a single-phase transformer with lagging p.f. load and leading p.f. load.	7M
	b)	A 25 kVA, 440/110 V, 50 Hz single-phase step-down transformer is designed to work with 1.5 V per turn with a flux density not exceeding 1.35 T. Determine (i) the required number of turns on the primary and secondary windings respectively, (ii) the cross-sectional area of the iron core, and (iii) the secondary current.	7M
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6. a) Explain how parameters of transformer equivalent circuit can be found from open circuit and short circuit tests. 7M

   b) A 20 kVA, 4000/200V, 50Hz transformer with an equivalent impedance of 0.02 Ω is to operate in parallel with a 15 kVA, 4000/200 V, 50 Hz transformer with an equivalent impedance of 0.025 Ω. The two transformers are connected in parallel and made to carry a load of 25 kVA. Assume both the impedances to have the same angle. 7M

      (i) Find the individual load currents

      (ii) What percent of the rated capacity is used in each transformer?

7. a) Explain with the help of connection diagrams the operation of on-load tap changer. 7M

   b) Explain the open-delta connection with a suitable diagram. What are the uses of this connection? 7M