G. S. Mandal's

Maharashtra Institute of Technology, Aurangabad

(An Autonomous Institute)

END SEMESTER EXAMINATION

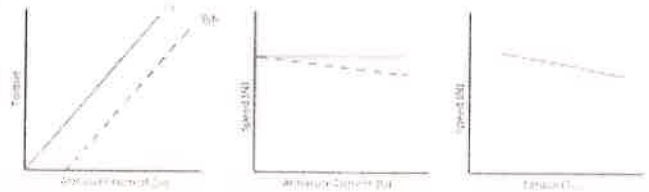
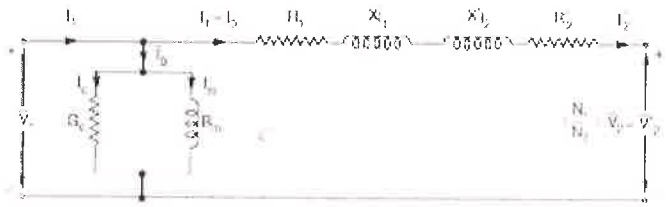
Second Year B.Tech (Branch) – Feb/Mar-2023

Course Code : EED202 **Course Name : Electrical Machines 1**

Duration : 2 Hrs **Max. Marks : 50** **Date :**

Marking Scheme

Q. 1

		Marks
a)	Draw Characteristics of DC Shunt Motors.  Characteristics of DC shunt motor	2
b)	What are different losses in transformer. Eddy current, Hysteresis, Copper	2
c)	Write any 4 applications of Synchro's water level detection, water gate control, welding machines, transporting machines, aircraft, and measuring instruments.	2
d)	Draw transformer equivalent circuit referred to secondary 	2
e)	Define Back pitch and front pitch Back pitch YB the distance between the top and bottom coil sides of a coil measured around the back of armature is called back pitch. Front pitch YF the distance between the two coil sides connected to the same commutator segment is called front pitch.	2
f)	Write causes of bad commutation A machine is said to be in poor commutation if there is sparking at the brushes and commutator surface. Poor commutation can be caused by mechanical or electrical condition. 2) Non uniform brush pressure. 3) Vibration of brushes in brush holders	2
g)	Brief polarity test in transformer The polarity of a transformer can be additive or subtractive. To find the additive or subtractive polarity, connect one terminal of primary winding with one terminal of the secondary winding and connect the remaining terminals of primary and secondary winding with a voltmeter.	2
h)	Write significance of back emf in DC motor. The decreased back emf causes the larger current to flow through the armature and the large armature current means increased developed torque by the motor. Hence, the torque is increased when the motor slows down. The motor will stop slowing	2

down when the armature current is sufficient to produce the increased torque required by the load

When the load on the motor is decreased, then the torque is momentarily more than the requirement so that the armature is accelerated. As the speed of the armature increases, the back emf also increases and causes the armature current is decrease. The motor will stop accelerating when the armature current is sufficient to develop the torque required by the load

Q.2 Solve both the following

a) An 8-pole DC shunt generator with 778 wave-connected armature conductors and running at 500 r.p.m. supplies a load of 12.5 Ω resistance at terminal voltage of 250 V. The armature resistance is 0.24 Ω and the field resistance is 250 Ω. Find the armature current, the induced EMF and the flux per pole.

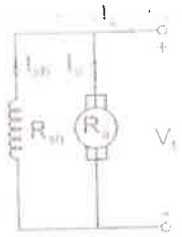
Calculation:

Given that,

Terminal voltage V = 250 V

Load Resistance R_L = 12.5 Ω

Feild resistance R_{sh} = 250 Ω



For shunt generator, apply KCL at node we get

Armature current $I_a = I_{sh} + I_L$

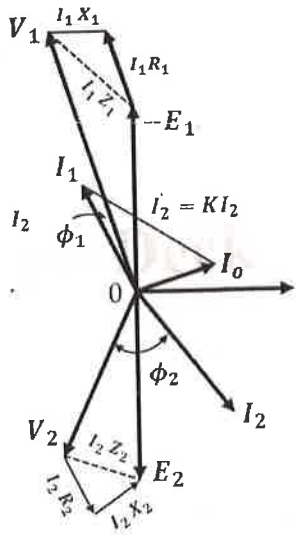
We know that,

Field current $I_{sh} = V/ R_{sh} = 250/250 = 1A$

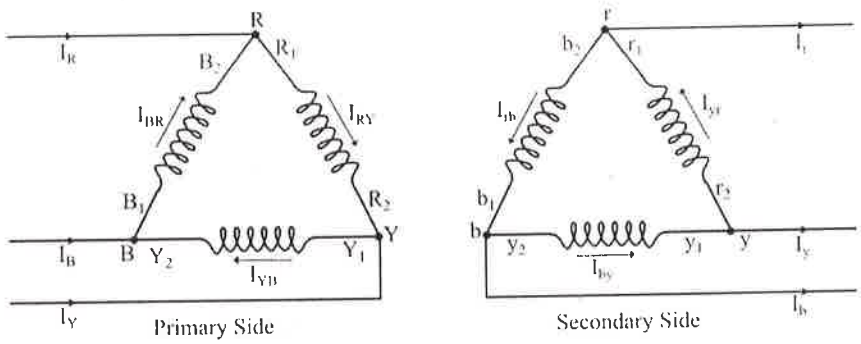
Load current $I_L = V/ R_L = 250 / 12.5 = 20$ A

$\Rightarrow I_a = 20 + 1 = 21$ A

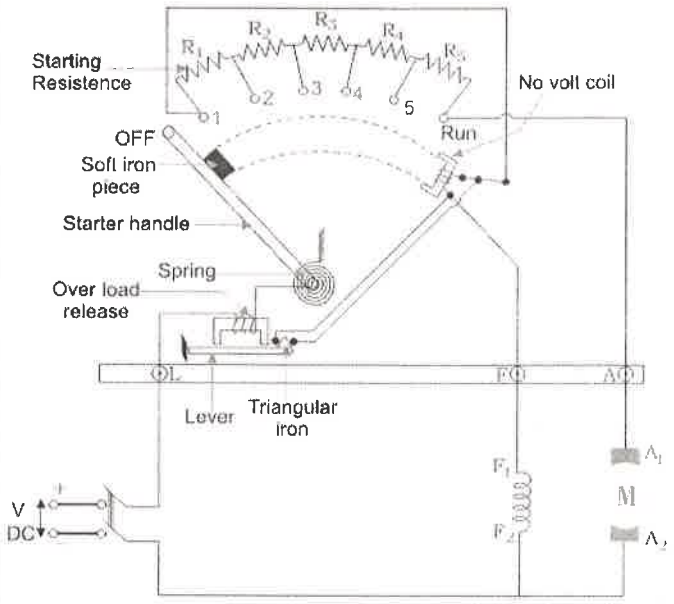
b) Describe phasor diagram of transformer when leakage reactance is considered for capacitive load



Q.3 Solve any one from the following

Q.4	Solve both the following a) Derive condition of maximum efficiency of transformer Derivation of Iron losses equal to copper losses 4M b) Brief low inertia DC motor in detail explanation 4M	4 4
Q.5	Solve both the following a) Brief about Permanent magnet DC Motor The permanent magnet dc motor can be defined as a motor which includes a permanent magnet pole is called Permanent Magnet DC Motor. In this motor, the magnet can be used to make the flux working within the air gap in its place of the field winding. The rotor structure is similar to the straight DC Motor. PMDC Motor's rotor includes armature core, commutator, & armature winding. Normally, in a conventional DC motor, there are two kinds of winding such as armature as well as Filed. **Advantages 1M, Diagram 1 M and Explanation 2M** b) Discuss Delta Delta connection in 3 phase transformer The ***delta-delta connection*** of the primary and secondary windings of a three-phase transformer is shown in the figure. Here, the secondary winding r_1r_2 corresponds to the primary winding R_1R_2, and the terminals R_1 and r_1 have same polarity. Also, the polarity of terminal **r** connecting the r_1 and b_2 is the same as that of R connecting R_1 and B_2.  Primary Side Secondary Side The phasor diagram is drawn for the usual case of lagging power factor load. Here, the magnetising current and voltage drops in the impedances have been neglected. Under balanced condition, the line currents are √3 times of the phase currents and lags behind the phases currents. In case of the delta-delta connection, the corresponding line voltages and phase voltages are same in magnitude on both primary and secondary windings.	4 4
Q.6	Solve any one from the following a) Explain construction of DC Machine with all parts Diagram 2M Any 6 Parts 1 M Each Yoke, Brush, Pole shoe, Armature, Armature winding, pole winding, commutator OR b) Brief speed control techniques in DC Shunt motor Armature control 4M Field control 4M	8

Describe 3 Point starter in detail with its diagram.



Three Point Starter

Diagram 4M
Explanation 4M

8

OR

A single phase transformer has 1000 turns on primary and 200 turns on secondary. The no load current is 3amp at a power factor of 0.2 lagging. Calculate the primary current and power factor when the secondary current is 280Amp at a power factor of 0.8 lagging.

2

$$\frac{I_P}{I_S} = \frac{N_S}{N_P}$$

Therefore, $I_P = \frac{N_S}{N_P} \times I_S = \frac{200}{1000} \times 280 = 56A$

$\cos\varphi_2=0.8$ $\cos\varphi_0=0.2$ $\sin\varphi_2=0.6$ $\sin\varphi_0=0.98$

2

solve for horizontal and vertical components

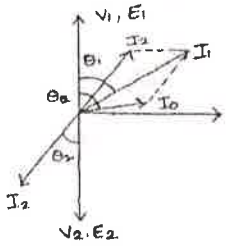
$I_1\cos\varphi_1=I_2\cos\varphi_2+I_0\cos\varphi_0$ $=(56\times0.8)+(3\times0.2)=45.4A$

$I_1\sin\varphi_1=I_2\sin\varphi_2+I_0\sin\varphi_0$ $=(56\times0.6)+(3\times0.98)$ $= 36.54A$

$I_1=\sqrt{45.4^2+36.54^2}=58.3A$

$I_\mu=I_0\sin\varphi_0=(3\times0.6)=1.8A$

2



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$\tan\varphi_1 \frac{36.54}{45.4} = 0.805$

$\varphi_1=38°$

Power factor $\cos\varphi_1=\cos38°=0.78$ lagging.

A.S. Boorle