BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : IV**
BRANCH: EEE **SESSION : SP/19**

SUBJECT: EE4203 ELECTRICAL MACHINES - I

TIME: 3.00 Hrs. **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
6. Normal Graph Paper Required

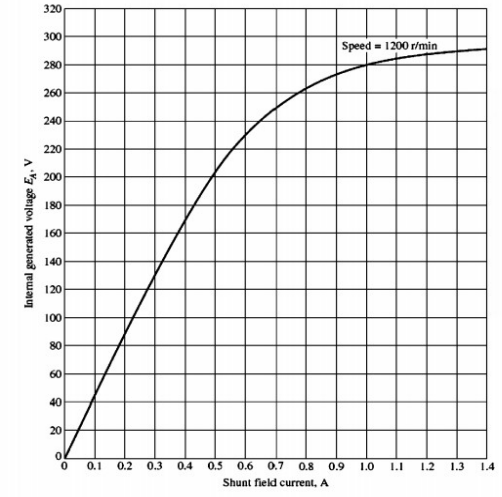
Q.1(a) Explain the three methods of linking a conductor with flux and cite some example. [2]
Q.1(b) Describe different methods of cooling of electrical machines. [4]
Q.1(c) In a rotating electrical machine, having 2-poles on the stator and 4-poles on the rotor, show that net electromagnetic torque developed is zero. [6]

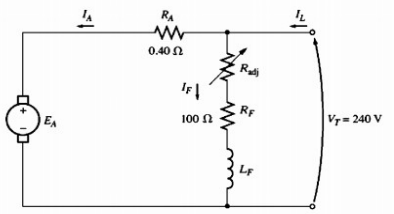
Q.2(a) Explain the relation between electrical and mechanical degree for 4-pole d.c motor. [2]
Q.2(b) Distinguish between (a) armature winding and field winding, (b) load current and exciting current. [4]
Q.2(c) A long shunt generator at 1000 r.p.m supplies 22kw at a terminal voltage of 220v. The armature, shunt field and series field resistances are 0.05 ohm.110 ohm and 0.06 ohm respectively. The overall efficiency at the above load is 88%. Find constant losses and variable losses. [6]

Q.3(a) Define reactance voltage. What is its effect? Why is it necessary to neutralize it? How can it be done? [2]
Q.3(b) A 6-pole, 12kW, 240V dc machine is wave-connected. If this machine is now lap-connected, all other things remaining same, calculate its voltage, current and power ratings. [4]
Q.3(c) A shunt generator supplies 100A at a terminal voltage of 200v. The prime mover is developing 32 bhp. Rsh= 50 ohm, Ra= 0.1 ohm. Find iron and friction losses, copper losses and commercial efficiency. [6]

Q.4(a) What is the advantage of having the flat-topped wave of flux density in air around the dc machine armature periphery? [2]
Q.4(b) A 24kW, 250V, 1600rpm separately excited DC generator has armature circuit resistance of 0.1Ω. The machine is first run at rated speed and the field current is adjusted to give an open circuit voltage of 260V. When the generator is loaded to deliver its rated current, the speed of the driving motor is found to be 1500rpm. Compute the terminal voltage of the generator under these conditions. Field flux remains unaltered. [4]
Q.4(c) Draw a circuit diagram of two shunt generators in parallel. Explain the process of putting generator in parallel with the busbar and taking a generator off the busbar and shutting it down. [6]

Q.5 Consider the following for a dc motor:
P_{rated} = 15hp, $I_{L,rated}$ = 55A, V_T = 240V, N_F = 2700 turns per pole, n_{rated} = 1200rpm, N_{SE} = 27 turns per pole, R_A = 0.40Ω, R_F = 100Ω, R_S = 0.04Ω, R_{adj} = 100 to 400 Ω.
Rotational losses are 1800W at full load. Magnetization curve is shown in figure below. Assume the motor described above can be connected in shunt. The equivalent circuit of the shunt motor is shown in figure below.





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(i) If the resistor R_{adj} is adjusted to 175Ω what is the rotational speed of the motor at no-load conditions? [2]

(ii) If R_{adj} can be adjusted from 100 to 400 Ω, what are the minimum and maximum no-load speeds possible with this motor? [2]

(iii) What is the starting current of this machine if it is started by connecting it directly to the power supply V_T? [2]

(iv) Assume the motor is operating at full load and that the variable resistor R_{adj} is 175 Ω. If the armature reaction is 1200AT at full load, what is the speed of the motor? [4

Q.6(a) What are the idealizing assumptions made for an ideal transformer? [2]

Q.6(b) Draw and explain the phasor diagram of a transformer with lagging load. [4]

Q.6(c) A 20 kVA, 2500/250 V, 50Hz, single-phase transformer gave the following test result: [6]

Open-circuit test (on l.v. side): 250V, 1.4A, 105 watts.
Short-circuit test (on h.v. side): 104V, 8A, 320 watts.
Compute the parameters of the approximate equivalent circuit referred to high-voltage side. Also draw the exact equivalent circuit.

Q.7(a) What is the difference between a two winding transformer and an autotransformer? [2]

Q.7(b) Explain the conditions for the satisfactory and successful parallel operation of transformers. [4]

Q.7(c) Open circuit test and short circuit test are suitable for calculating the efficiency of transformer, but still we use load test (back-to-back) test in some situation, when & why we require this test? Explain back-to-back test with proper diagram. [6]

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