CLO #1: Investigate working of a DC Machine

Q1: **[marks =25]**

A 30HP, 240V compensated DC shunt motor has armature resistance of 0.35 Ω. Its field resistance is 90 Ω and adjustable resistance connected in series with field coil can vary from 70 Ω to 300 Ω. Its no load characteristic curve at a speed of 1400 rpm is tabulated as under.

I_F (A)	0.3	0.6	0.9	1.2	1.4	1.6
E_A (V)	130	230	274	288	292	295

Investigate the DC machine to find out following quantities assuming rated terminal voltage in all cases.

a) What is the maximum and minimum no load speed at which this motor can operate
b) No load speed of motor if adjustable resistance connected in series with field coil has been set to a value of 120 ohm.
c) The induced torque in loaded condition at line current of 70A, with same field current as in part (b)
d) Fully labeled Circuit diagram for part (c)
e) Also draw the general torque speed curve of a compensated DC shunt motor

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CLO #3: Analyze Synchronous Generator performance along with special emphasis towards environmental cost of generation

Q2: **[marks 25]**

A **2300** V, **1200** KVA, 0.85-PF-lagging, 50-Hz, 24 pole, Y-connected synchronous generator, has a synchronous reactance of 1.2 Ω and an armature resistance of 0.2 Ω. At 50 Hz, its friction and windage losses are 28.5 KW, and its core losses are 23.5 KW. The field circuit has a dc voltage of 220 V, and the maximum I_F is 10 A. The resistance of the field circuit is adjustable over the range from 12 to 200 Ω.
The generator is providing 250 A to a load at rated power factor and a terminal voltage of 2200V. ***Analyze*** the Synchronous Generator circuit to find out the following quantities

a) Rotational speed
b) Internally generated voltage
c) Voltage regulation
d) Efficiency
e) Output torque of prime mover