Benha University
Faculty of Engineering (Shoubra)
Power engineering and sustainable energy Dept.
4th Year Electrical Power

2018-2019 Final-Term Exam
Course Title: Energy Storage & Transmission
Time Allowed: 2 hours
Date: 28-05-2019

This is a closed book exam. The exam consists of two pages. Attempt all questions

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Q.*1 *Write true or false with correcting the wrong statement ***[10 marks]***

1) Energy is broadly classified into two main types renewable and non-renewable.
2) The Egyptian transmission voltage levels are 500 kV, 220 kV, 132 kV, 66 kV.
3) Nonrenewable resources cannot be replaced or are replaced much more slowly than they are used.
4) Energy storage devices are discharged when they absorb energy.
5) Energy storage based on lithium-ion battery provides reliable and fast frequency response.
6) Flywheel is the type of storage system uses mechanical energy to store energy.
7) Compressed air is an energy storage system which is usually built in abandoned mines.
8) Energy resources that are renewable can be used up.
9) Disconnect switch provides visible circuit separation and can be operated only in no-load condition.
10) The purpose of the electric transmission system is the efficient interconnection of the generating stations with the loads.
11) Charge and discharge normally require power conversion devices, to transform electrical energy (AC or DC) into a different form of electrical, thermal, mechanical or chemical energy.
12) Electricity stored during off-peak time can be used during no-peak hours so that home/commercial owners can cut peak demand and electricity cost.
13) Pumped hydro storage, compressed air energy storage, hydrogen and thermal storage are characterized by their ability to store energy over time (several hours).
14) For accurate modeling of the transmission line, the parameters are assumed to be distributed throughout line.
15) Incandescent lamps and electric heaters are common examples of inductive loads.
16) The load factor is the ratio of average load over designated period of time to the peak load occurring in that period.
17) The Egyptian strategy for energy supply and use aims to increase the renewable energy share of the total energy demand to 20% by 2020 with contribution 12% from solar.
18) Engineering, Procurement and Construction (EPC) is a form of contracting arrangement where the EPC contractor is made responsible for all from design, procurement, construction, commissioning and handover of the project to the end-user or owner.
19) Homopolar lines are those in which the line has one conductor only and the earth is used as the return conductor.
20) Geothermal energy caused by the heating of Earth's crust. This energy can be converted into electrical energy at power plants.

Q.*2** ***[10 marks]

a) Explain clearly what is meant by good quality supply, discuss the effect of bad supply on the performance of the system.

b) A bridge connected rectifier is fed from 220 kV / 110 kV transformer, operates with (commutation angle $\acute{\alpha}=20^{o}$ and overlap angle $\gamma=10^{o}$). (a) Determine the necessary line secondary voltage of the rectifier transformer, if it is required to obtain a d.c. output voltage of 87 kV, (b) Determine the tap ratio required and (c) Determine the d.c. output current, if the effective reactance per phase 9.25 Ω.

Q.*3** ***[10 marks]

a) Compare between types of overhead transmission lines.

b) A single-phase overhead transmission line delivers 1.1MW at 33 kV at 0.8 p.f. lagging. The total resistance and inductive reactance of the line are 10 Ω and 15 Ω respectively. Calculate: (i) sending end voltage (ii) sending end power factor and (iii) transmission efficiency.

Q.*4** ***[10 marks]

a) Enumerate the different types of rechargeable batteries and discuss the performance characteristic of the battery which influences the design.

b) Discuss in detail different types of energy storage systems.

c) The daily load on a power system varies as shown in Table (1). Using the given data compute the average load and the daily load factor.

Table 1. Daily System Load

Interval, hr	0 - 3	3 - 7	7 – 10	10 - 13	13 - 17	17 - 20	20 – 22	22 - 24
Load, MW	1	2	3	4	5	8	9	6