BITS, PILANI – DUBAI CAMPUS
Knowledge Village, Dubai

Semester II 2006 – 2007
IV Year (EEE)-Elective

Comprehensive Examination (Closed Book)

Course No.: EEE UC462 **Course Title:** Advanced Power Systems

Date: **28.05.2007** **Time: 03 Hours** **M.M. = 40** (40 %)

- *Attempt all question in serial order.*
- *Assume suitable data/assumptions, if needed.*

Q1. Explain why Electrical Energy is superior to all other forms of energy. [3]

Q2. Mechanical Energy is supplied to DC generator at the rate of 4200 J/s. The generator delivers 32.2 A at 120 V. What is the percentage efficiency of the generator and how much energy is lost per minute of operation? [4]

Q3. Discuss various parts of steam generating plant in a thermal power station. Draw the Schematic diagram for thermal power plant. [3+2]

Q4. Discuss various types of the loads. A generating station has a maximum demand of 25 MW, a load factor of 0.6, a plant capacity factor of 0.5 and a plant use factor of 72%. Find
1. The reserve capacity of plant
2. The daily Energy produced
3. Maximum energy that could be produced daily if the plant while running as per schedule, were fully loaded. [3]

Q5. The tariff in force is AED 150 per kVA of maximum demand and 8 fills per unit consumed. If the load factor is 30%, find the overall cost per unit at unity pf and 0.7 pf. [5]

Q6. Prove that in a string of insulators, the disc nearest to the conductor has maximum voltage across it. Justify your expression obtained. [5]

Q7. Estimate the distance over which a load of 15000 kW at a pf lagging 0.8 can be delivered by a 3 phase transmission line having conductors each of resistance 1 ohm per km. The voltage at the receiving end is to be 132 kV and the loss in transmission is to be 5%. [5]

Q8. A 50 MVA, 11 kV, 3 phase alternator was subjected to different types of faults. The fault currents are: 3 phase fault = 2000 A, L-L fault = 2600A and L-G fault = 4200A.
The neutral is solidly grounded. Find the values of the three sequence reactance of the alternator. Ignore resistances. [5]

Q9. A generator operating at 50 Hz delivers 1 pu power to an infinite bus through a transmission circuit in which resistance is ignored. A fault takes place reducing the maximum power transferable to 0.5 pu whereas before the fault, this power was 2.0 pu and after the fault clearance, it is 1.5 pu. By the use of equal area criterion, determine the critical clearing angle. [5]

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Test 2 (Closed Book)

Course No.: EEE UC 462 **Course Title:** Advanced Power Systems

Date: 13.05.2007 **Time:** 50Minutes **M.M. = 20** (20 %)

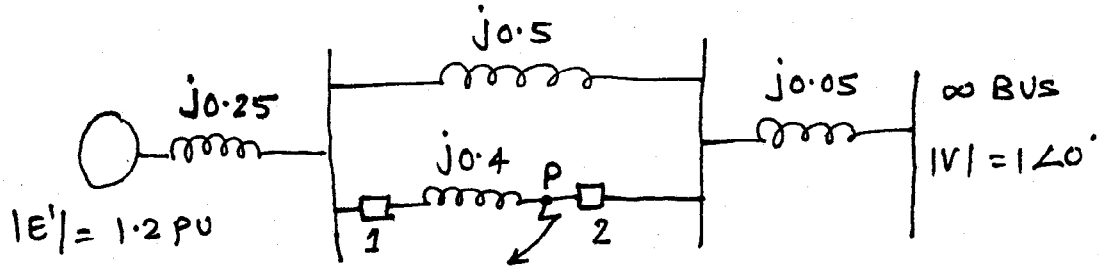
- ***Attempt all Questions, maintain the serial order.***
- ***Assume missing data, if any.***

Q.1 An overhead transmission line conductor having a parabolic configuration weighs 1.925 kg/meter of length. The area of the cross section of the conductor is 2.2 cm^2 and the ultimate strength is 8000kg/cm^2. The supports are 600 m apart having 15m difference of levels. Calculate the sag from the taller of the two supports which must be allowed so that the factor of safety shall be 5. Assume that ice load is 1 kg/m run and zero wind pressure. [5]

Q.2 The zero and positive sequence components of red phase are (0.5-j0.866) and $2\angle 0^0$ V. If the phase voltage Er is $3\angle 0^0$ V, find the negative sequence component of red phase and phase voltages E_y and E_b. [5]

Q.3 A delta connected load is supplied from a 3-phase supply. The fuse in the B line is removed and current in the other two lines is 20 A. Find the symmetrical components of line currents. [5]

Q.4 Given the system below where a three phase fault is applied at the point P. Find the critical clearing angle for the fault with simultaneous opening of the breakers 1 and 2. the reactance values of various components are indicated on the diagram. The generator is delivering 1.0 pu power at the instant preceding the fault. [5]



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Semester II 2006 – 2007
IV Year (EEE)-Elective

Test 1 (Closed Book)

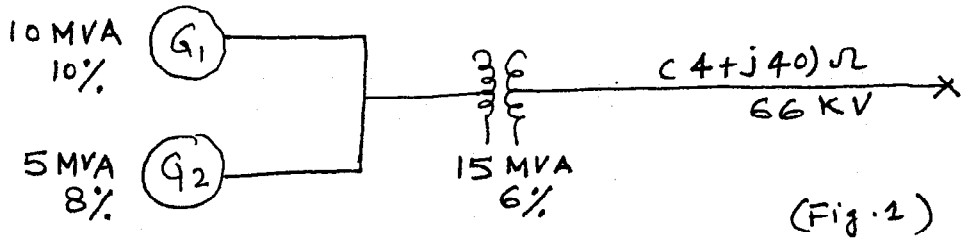
Course No.: EEE UC 462 **Course Title:** Advanced Power Systems

Date: 08.04.2007 **Time: 30**Minutes **M.M. = 20** (20 %)

- ***Attempt all Questions, maintain the serial order.***
- ***Assume missing data, if any.***

Q1. A 345 kV transmission line has a series impedance of (4 +j 60) Ω and a shunt admittance of j 2 x 10^{-3} S. Using 100 MVA and the line voltage as base values, calculate the per unit impedance and per unit admittance of the line. [2]

Q2. Draw an impedance diagram for the system shown in fig.1, expressing all values as percent values. [2]



(Fig.1)

Q3. A Power System has the following Daily Load Cycle:

Time in Hrs	6 – 8	8 – 12	12 – 16	16 – 20	20 – 24	24 – 6
Load (MW)	20	40	60	20	50	20

Plot the Load Curve and Load Duration Curve. Also calculate the energy generated per day. [2+2+1]

Q4. A 3 phase Transmission Line, 200 km long has the following constants:
Resistance/Phase/km = 0.16 Ω, Reactance/Phase/km = 0.25 Ω
Shunt Admittance/Phase/km = 1.5 x 10^{-6} S
Calculate by rigorous method the sending end voltage and current when the line is delivering a load of 20 MW at 0.8 pf lagging. The receiving end voltage is kept constant at 110 kV. [5]

Q5. Compare in Tabular form, the Steam Power Plants, Hydro Electric PP, Diesel PP and Nuclear PP on the basis of Site, Initial Cost, Running Cost, Cost of Fuel transportation, Cleanliness and simplicity, Overall efficiency, Maintenance cost. [5]

Q6. Define Ferranti Effect. [1]

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Semester II 2006 – 2007
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Quiz (Closed Book)

Course No.: EEE UC 462 **Course Title:** Advanced Power Systems

Date: 08.03.2007 **Time: 30Minutes** **-M.M. = 40** (10 %)

SECTION -A

Check whether the statements are True or false. **(1 x 10)**

1. Demand factor can be more than 1. ( )
2. Capital cost per kW of installed capacity is the same for large size and small size plants. ( )
3. The salvage value of a plant may be negative also. ( )
4. A nuclear power plant should be used as peak load plant. ( )
5. A large size plant has lower generation cost than a small size plant. ( )
6. Power factor of Induction motor running at half load is better than that at full load. ( )
7. Improvement of power factor leads to decrease in circuit current. ( )
8. A hydrograph is a graph of runoff in m^3/sec in different months. ( )
9. Natural Uranium contains more than 99% of U-234. ( )
10. MHD stands for Magneto HygroDynamic Generation. ( )

Fill the appropriate word/answer. **(2 x 10)**

11. The major heat loss in a steam power station is _____.
12. The thermal efficiency of a steam power plant is about _____.
13. Cooling towers are used where _____.
14. In hydro electric plant, spillways are used _____.
15. Off all the plants, minimum quantity of fuel is required in _____.
16. The area under daily load curve gives _____.
17. The lesser the Diversity factor, the _____ is the cost of generation of power.
18. In an annual load curve, _____ is taken along Y-axis and _____ along X-axis.
19. Depreciation is the _____ in value of equipment due to _____.
20. Average load is _____ if the load factor increases.

SECTION –B

1. Water for a hydro electric plant is obtained from a reservoir with a head of 100 meters. Calculate the electrical energy generated per hour per cubic meter of water if the hydraulic efficiency be 86% and electrical efficiency is 92%. [5]

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Quiz (Closed Book)

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Date: 08.03.2007 **Time: 30**Minutes **M.M. = 4**0 (10 %)

2. A distribution transformer costs AED 2,00,000 and has a useful life of 20 years. If the salvage value is AED 10,000 and rate of annual compound interest is 8%, calculate the amount to be saved annually for replacement of the transformer after the end of 20 years by sinking fund method. [5]