

**BITS, Pilani –Dubai Campus  
Knowledge Village, Dubai  
Year 2004-2005, Semester I**

**IVth Year- EEE**

**First Test**

**EEE UC462 – Advanced Power Systems**

**Max Marks 20**

**Time: 50 Minutes**

Answer all questions. Each question carries equal marks

Q 1 A power system comprising of a hydroelectric and a steam power station has to supply a maximum demand of 300MW and a minimum of 100 MW. Hydro power available at the time of minimum flow is just enough to meet the peak energy demand of 7,200,000 kWh per day. It is proposed to pump water from its tail race to its upstream reservoir by utilizing the available power from the steam power station during off peak period and running it at 100% load factor. The load may be assumed to vary between the maximum and minimum limits uniformly in the day. Determine the maximum capacities of the two power stations for maximum overall efficiency. The efficiency of the thermal plant may be assumed as 60% for this purpose. (10)

Q2 Describe the auxiliaries of a steam power plant and explain their functions in brief. (5)

Q3 What is M.H.D form of power generation? How is it more efficient than the conventional thermal power plants? (5)

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## Test 1 - Make up

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Answer all questions. Each question carries equal marks

Q1 A generating station has a maximum demand of 75MW and a yearly load factor of 40%. Generating costs inclusive of station capital costs are Rs 60 per annum per kw demand plus 4 paise per kwh transmitted. The annual capital charges for transmission system are Rs 20,00,000 and for distribution system Rs 15,00,000, The respective diversity factors being 1.2 and 1.25. The efficiency of transmission system is 90% and that of distribution system is 85%. Find the yearly cost per kw demand and cost per kwh supplied at the substation and at the consumers premises.  
(8)

Q2 What is the importance of diversity factor of power station? (1)

Q3 What do you understand by run off river plant? How introducing a pondage increases its performance? Draw a layout of hydroelectric station and discuss its various components (6)

Q4. Write short notes on non conventional energy sources (5)

OR

Q4 Name different types of Nuclear Reactors. Write the name of fuel, moderator, and coolant used for different type of Nuclear reactors. Discuss any one of them in details. (5)

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IVth Year- EEE

## Second Test (Open Book)

**ONLY CLASS NOTES AND TEXT BOOK ARE  
ALLOWED**

**EEE UC462 – Advanced Power Systems**

**Max Marks 20**

**Time: 50 Minutes**

Answer all questions. Each question carries equal marks

- Q1 Explain why the ratio of reset to Pick up in a protective relay should be high? (5)
- Q2 An alternator is provided with earth fault protection. The rating of alternator is 13.8 kV and 10 MVA. The relay setting is set to trip at 20% out of balance. The percentage of generator winding protected is 85%. Find the resistance to be included in the neutral to ground connection of the generator. (8)
- Q3 What are unit system and non unit system of protection. (2)
- Q4 A 100/5 A bar primary current transformer supplies an over current relay set at 25% pick up and it has a burden of 5 VA. Determine the knee point voltage and cross-section of the core if the CT has 50 turns on its secondary and the fault current is 15 times the relay setting. Assume the flux density as 1.4 Wb/ m<sup>2</sup> (5)

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**Make up**

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**IVth Year- EEE**

**EEE UC462 – Advanced Power Systems**

**Max Marks 20**

**Time: 50 Minutes**

Q1 A 3 phase 220/11000 V transformer is connected in star delta and the protective transformer on the 220V sides have a current ratio of 600/5. What must be the ratio of the CTs on the 11000 V side and how shall they be connected (5)

Q2 A star connected 3 phase 10 MVA, 6.6 kV alternator has a per phase reactance of 10% . It is protected by differential protective scheme which is set to operate for fault current not less than 175 A. Calculate the value of earthing resistance to be provided in order to ensure that only 10% of the alternator winding remains unprotected. (10)

Q3 Explain why the ratio of reset to Pick up in a protective relay should be high? (5)

Name

ID No

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### Comprehensive Exams

IVth Year- EEE

EEE UC462 – Advanced Power Systems

Max Marks 40

Time: Three Hours

Answer all questions

Q1 a) Explain how load curves help in the selection of size and number of generating units. Write the advantages of interconnected grid system. (3)

b) Compare the annual cost of power supply to a factory having a maximum demand of 500kW and a load factor of 40% by having the supply from:

- i) The factory's own diesel generating plant
- ii) A public supply

With regards to i) the capital cost of factory's own generating plant is Rs. 8 lakhs, cost of fuel oil is Rs. 200 per ton, fuel consumption 0.2951 kg / kWh. Capital charges cost of repairs and maintenance, interest and depreciation 15% of the total capital cost. Salaries and wages of the operating staff are Rs. 15000 per year.

With regards to ii) , the tariff is Rs. 150 per kW per annum of maximum demand plus 2.5 paise per kWh.

Which of the two alternatives is favorable for the operation of the factory. (5)

Q2 a) Classify the nuclear reactors according to the type of fuel, coolant, moderators and type of moderator assembly used. With the help of neat sketch explain the functioning of pressurized water reactor. (4)

b) Find the available continuous power of a hydroelectric station from the following data.

Catchments area=200 sq km

Annual rain fall = 1000mm

Effective load=200mt

Yield factor to allow runoff and loss by evaporation is 50%

Efficiency of plant =80%

(1)

c) What are the different forms of alternative energy sources? Write their advantages and disadvantages.

(3)

Q3 a) Draw the single line diagram of power system. Draw an impedance diagram for the system shown in figure 1, expressing all values as per unit values. Choose 50kVA as the base Kva. (4)

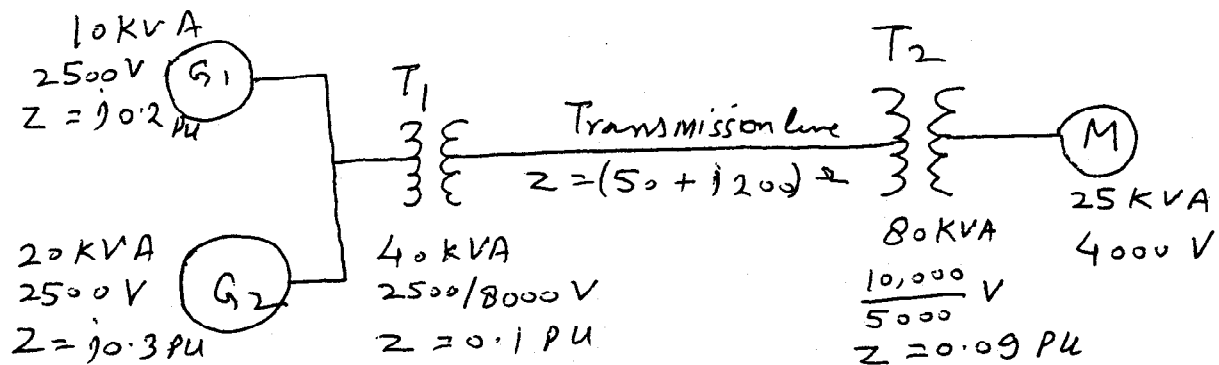


Figure 1

b) What is Corona loss? A 100 km long 3 phase 50 Hz transmission line has following line constants.

Resistance/phase/km = 0.1 Ohm

Reactance/phase/km = 0.5 Ohm

Suceptance/phase/km =  $10 \times 10^{-6} \text{ S}$

If the line supplies load of 20MW at 0.9 pf lagging at 66kV at the receiving end, calculate transmission line efficiency by nominal Pie method. (4)

Q 4 a) A delta connected load is supplied from a 3 phase supply. The fuse in one of the three lines is removed and current in other two lines is 20A. Find the symmetrical components of the line currents. (4)

b) What is equal area criterion? Derive Swing equation and discuss its application in the study of power system stability. (4)

Q5 a) Discuss current chopping phenomenon occurring in circuit breakers. Define restriking voltage, recover voltage and RRRV terms used in the analysis of circuit beaker. (4)

b) What is meant by 3 zone protection? Give such scheme of protection for long lines. With the help of a block diagram show how a phase comparison scheme can be used for the protection of transmission line from both end of the line. (4)

OR

5 (b)' A synchronous generator rated at 20 KV, protected by balanced circulating current system has its neutral grounded through resistance of 15 ohm. The differential protection relay is set to operate when there is an out of balance current of 3 A. The C.Ts have a ratio 1000/5. Determine:

- The percentage winding that remains unprotected and
- The minimum value of earthing resistance required to protect 75% of the winding. (4)