UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2011/2012

COURSE NAME	:	POWER SYSTEMS
COURSE CODE	:	BEF 25503
PROGRAMME	:	BED / BEU
EXAMINATION DATE	:	JUNE 2012
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

THIS PAPER CONSISTS OF **SIX** (6) PAGES

Q1   (a)   For proper working of a complete power system it requires its fundamental building blocks.

   (i)   Draw a neat block diagram of a complete power system, define each block.
(2 marks)

   (ii)   Explain the importance of exploration of renewable energy sources nowadays.
(2 marks)

   (iii)   Suggest any two potential renewable sources for power generation in Malaysia.
(1 mark)

   (b)   Loads are of many types. Broadly speaking they are: light load, medium load, heavy load used at different locations.

   (i)   With the help of characteristic differentiate between daily load curve and load duration curve.
(2 marks)

   (ii)   Draw a characteristic showing base, intermediate and peak load.
(1 mark)

   (iii)   Discuss the application of base power station, intermediate power station and peak power station.
(2 marks)

   (c)   Suppose in a house there are fifteen, 60 watt lamps that are operated as follows:
            5 lamps from 6p.m. till 8p.m.
            10 lamps from 8p.m. till 10p.m.
            6 lamps from 10p.m. till 12p.m.
Determine:

   (i)   The connected load, the maximum demand and the daily load Factor.
   (ii)   The improved daily load factor if a 2 kW heater is added and is used from 1 p.m. till 5 p.m. and again from 8 p.m. till 12 p.m.
(15 marks)

Q2   (a)   (i)   Define the grid network.
(1 mark)

   (ii)   List advantages of an interconnected substations
(1 mark)

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(iii)   Discuss voltage regulation

(1 mark)

(iv)   Enlist two disadvantages of low power factor

(2 marks)

(b)   Electric power generation has been playing an important role in the standard of living of a human being.

(i)   Enumerate advantages and disadvantages of thermal power plant.

(3 marks)

(ii)   As a power system engineer, describe the concentration towards exploration of potential sources of renewable energy sources.

(2 marks)

(iii)   Explain the use of sun energy in different ways.

(2 marks)

(c)   From the circuit shown in Figure 2(c), the given parameters are:

$V = 1200\angle0^0$ V, $Z_1 = 60 + j0\ \Omega$, $Z_2 = 6 + j12\ \Omega$ and $Z_3 = 30 - j30\ \Omega$.

Find the power absorbed by each load and the total complex power by using both methods of individual current and total current.

(13 marks)

Q3   (a)   (i)   Sketch a neat structure of the hydro power station. Write their respective names.

(2 marks)

(ii)   Define each major part of a hydro power plant as drawn in Q3(a)(i).

(3 marks)

(b)   (i)   List any four hydro power plants in Malaysia by providing their respective geological status.

(2 marks)

(ii)   Discuss classification of hydro electric power plants.

(3 marks)

(c)   Let two generators in parallel feeds a motor load through transmission link. If the parameters for this system are:

Generator $G1$: 10 kVA, 2500 volts, $X_d = $ j0.2 p.u.
Generator $G2$: 20 kVA, 2500 volts, $X_d = $ j0.3 p.u.
Step up transformer $T1$: 40 kVA, 2.5 kV/8 kV, $X = $ j0.1 p.u.
Step down transformer $T2$: 80kVA, 10kV/5kV, $X = $ j0.09 p.u.
Transmission Line TL: $Z = $ 50 + j200 ohms
Motor rating 25 kVA, 4000 volts, $Z = $ 0.25 p.u.

(i)   Draw a neat one line diagram from the above data.

(3 marks)

(ii)   Calculate p.u. quantities of each component for impedance diagram on 50kVA base.

(7 marks)

(iii)   Draw the impedance diagram showing all the calculated values in Q3(c)(ii).

(5 marks)

Q4   (a)   Classify transmission system in terms of:

(i)   Voltage

(2 marks)

(ii)   Distance

(3 marks)

(b)   The importance of poles or towers and insulators for transmission line are from their respective application point of view.

(i)   Discuss any three pole characteristics.

(2 marks)

(ii)   Enumerate the characteristics of suspension, strain and shackle type insulators.

(3 marks)

(c)   Transmission line consists of electrical parameters:

(i)   By giving reason list the least significant parameters. With the help of their respective diagrams briefly discuss each parameter.

(5 marks)

(ii)   With the help of diagram discuss the method of reducing capacitance effect.

(5 marks)

(iii)   Draw the equivalent circuit of short and medium lines. Clearly highlight its parameters in the diagram.

(5 marks)

Q5   (a)   Electricity is fed to the consumers through distribution system via distribution grid:

(i)   Enumerate different parts of a typical distribution system.

(2 marks)

(ii)   Discuss main features of a distribution sub station.

(3 marks)

(b)   (i)   Specify the considerations for any power system protection arrangements.

(2 marks)

(ii)   Explain any three protective equipments in distribution system.

(3 marks)

(c)   A 20 MVA, Δ/Y connected, 33/11 kV transformer is protected by differential relays with taps. CT ratio of 300 : 5 and 1000 : 5 is used on the 33 kV and 11 kV side, respectively.

(i)   Propose the connection of CT in this protection scheme.

(3 marks)

(ii)   Construct the overall protection scheme diagram.

(3 marks)

(iii)   Calculate the primary and secondary current of the transformer at rated conditions.

(3 marks)

(iv)   Calculate the minimum relay current setting to allow 110% overload of rated conditions.

(3 marks)

(v)   Repeat step in Q5(c)(iv) when the minimum relay current setting to allow 125% overload of rated conditions.

(3 marks)

FINAL EXAMINATION

SEMESTER/SESSION : SEM II/ 2011/2012   PROGRAMME   : BEE
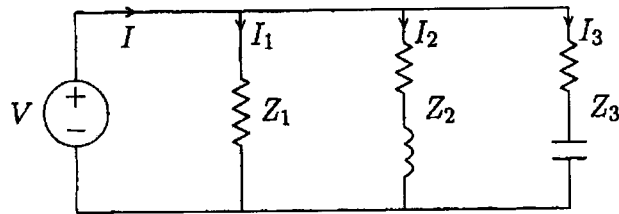COURSE   : POWER SYSTEM   COURSE CODE : BEE 25503

FIGURE Q2(c)