AZD

2011

430044

ELECTRICAL ENGINEERING (Optional)
Paper – I

Standard : Degree **Total Marks : 200**

Nature : Conventional (Essay) Type **Duration : 3 Hours**

N. B. :

1) *Answers must be written in English.*
2) *Question **No. 1** is **compulsory**. Of the remaining questions, attempt **any four** selecting **one** question from **each Section**.*
3) *Figures to the **RIGHT** indicate marks of the respective question.*
4) *Use of log table, Non-Programmable calculator is permitted, but any other Table/ Code/Reference book are not permitted.*
5) *Make suitable assumptions, wherever be necessary and state the same.*
6) *Number of optional questions upto the prescribed number in the order in which they have been solved will only be assessed. Excess answers will not be assessed.*
7) *Credit will be given for orderly, concise and effective writing.*
8) *Candidates should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise he/she will be penalised.*

SEAL

Marks

1. Answer **any four** of the following (**10** marks **each**) :

(a) Calculate the current required by a 1000 V dc motor used in locomotive when driving a total load of 100 tonnes at 25 km per hour up an incline of 1 in 100. Assume track resistance of 0.069 N/kg and efficiency of motor and gearing as 70%. **10**

(b) With the help of circuit diagram and phasor diagram explain operation of DC Sauty's Bridge used for capacitance measurement. Also derive formula for unknown capacitance in terms of other circuit parameters. **10**

(c) A 220 kV, 3 phase transmission line is 40 km long. The resistance per phase is 0.15 Ω/km and inductance per ph is 1.3263 mH/km. The shunt capacitance is negligible. Use short line model to find voltage and power at the sending end and the voltage regulation and efficiency when line is supplying 38/MVA at 0.8 p.f. lagging at 220 kV. Take frequency as 60 Hz. **10**

(d) State and explain various types of semiconductor memories (ROM). **10**

(e) A 3 phase, 50 Hz oil cooled core type transformer has the following dimensions distance between core centres 0.2 m, height of window 0.24 m, diameter of circumscribing circle 0.14 m. The flux density in core 1.25 T and current density 2.5 Δ/mm^2. Calculate kVA rating. Take window space factor 0.2 and core area factor 0.56. The core is 2 stepped. **10**

P.T.O.

Marks

SECTION – A

2. Answer the following sub-questions :

(a) A series R-C circuit consists of 10 ohm resistor and 0.1 F capacitor. The combination is supplied by 20V battery at t = 0. Obtain the current equation and voltage across resistor and capacitor. **10**

(b) What are travelling waves ? Obtain its mathematical expression. **10**

(c) (i) Draw torque-speed and torque-current characteristics of shunt and series motors. **5**

(ii) 2 similar 6600 V, 3 phase alternators running in parallel at constant voltage and frequency. Each as resistance of 0.05 ohm and synchronous reactance of 0.5 ohm and supplies half the load of 1000 kW at 0.8 pf lagging when excited similarly. If excitation of machine 1 be adjusted until armature current is 438 A when steam input to turbine remains same. Find armature current, emf and power factor of other machine. **15**

3. (a) For the network shown in Figure 1 find value of (V_2/V_1). **10**

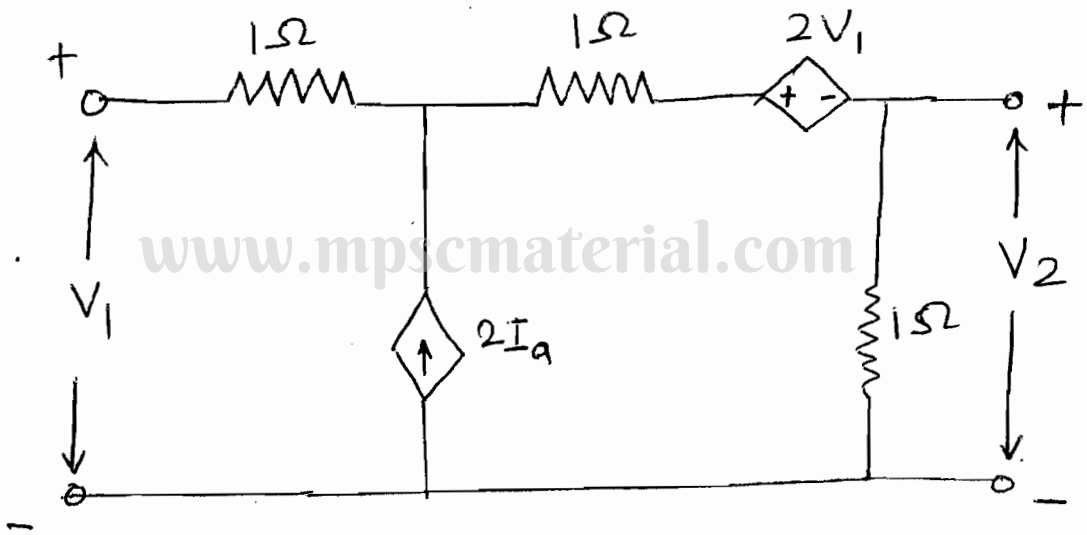

Figure 1 Two Port Network

(b) Obtain ABCD parameters of a distributed parameter transmission line model. Consider 'T' configuration for ABCD parameter calculation. **10**

(c) (i) A 200 V shunt motor having resistance of 0.4 ohm takes armature current of 20 A, on full load and runs at 600 rpm. If resistance of 0.5 ohm is placed in the armature circuit. Find speed at full load torque. **5**

(ii) 400 V, 3 phase, 50 Hz, 6 pole cage motor takes, when started by direct switching 40 kW and line current 160 A. Torque developed being equal to full load. If full load speed is 960 rpm and mechanical losses are 1 kW, find the rated HP and full load current. Neglect no load current and stator losses. **15**

Marks

SECTION – B

4. (a) Answer the following sub-question :
   (i) Explain Q factor of inductance and capacitance. 5
   (ii) State the comparison between temperature measurement transducer thermo couple and thermistor. 5

   (b) Obtain transfer function of the system shown in the Figure 1 {Q. 4 (b)] 10

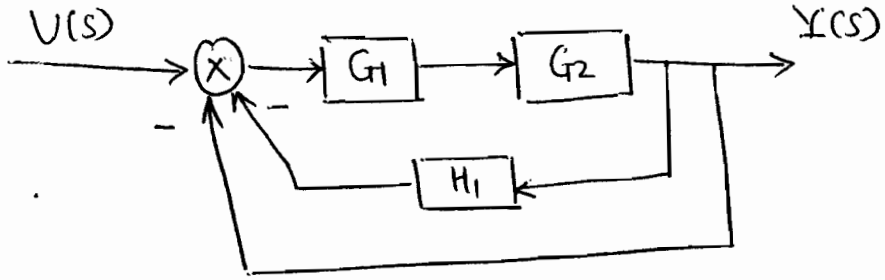

Fig. 2 [Q. 4 (b)]

   (c) Closed loop second order system has damping factor = 0.5 and natural frequency of oscillation 4 rad/sec. Determine transfer function of the system and overshoot of the system it excited by step input. 10

   (d) Obtain state space representation (state model) of the system

$$\frac{Y(S)}{U(S)} = \frac{10S + 1}{S^2 + 6S + 20}$$

   where U(S) = input to the system
   Y(S) = O/p of the system. 10

5. (a) (i) Write any four oscilloscope specifications. 5
   (ii) Various uses of megger. 5

   (b) Discuss any two applications of open loop and closed loop systems used in practice. 10

   (c) A system is described by characteristic equation

$$S^4 + 8S^3 + 36S^2 + 80S + 100 = 0$$

   By Routh's criterion, decide the system is stable or unstable. 10

   (d) Plot the pole-zero configurations of lag and lead network. Also write the general expression of the above configurations. 10

SECTION – C

6. Answer the following sub-questions.
   (a) Obtain relation in terms of symmetrical components of line to line fault. 10
   (b) Define insulation coordination and state different controlling techniques of over voltages. 15
   (c) (i) State advantages of HVDC system. 5
   (ii) A two bus system in which G is connected at bus 1 and generator 2 is connected at bus 2 along with load. The buses are connected by a transmission live. A load of 237.04 MW at bus 2. Find the optimum load distribution between 2 plants for

P.T.O.

Marks

(a) when losses are included but not coordinated

(b) when losses are also coordinated. Also find the savings in rupees/hr when losses are coordinated incremental costs.

$$\frac{dC_1}{dPG_1} = 0.02\,PG_1 + 16.0\ Rs/MWh$$

$$\frac{dC_2}{dPG_2} = 0.04\,PG_2 + 20.0\ Rs/MWh$$

$\lambda =$ Rs. 25/MWh. 10

7. Answer the following sub-questions.

(a) A 3 phase, 60Hz, 500 KV transmission line is 300 km/mg. The line inductance is 0.97 mH/km per phase and its capacitance is 0.0115 μF/km/ph. Line is loss less,

(a) Calculate the receiving end voltage when line is terminated in an open circuit and is energized with 500 KV at sending end.

(b) Determine the reactance and the MUAr of a 3 phase shunt reactor to be installed at the receiving end to keep the no load receiving end voltage at the rated value. 10

(b) Explain differential protection scheme for transformers. 15

(c) (i) Draw schematic of UPFC and explain its basic concept. 5

(ii) Explain turbine generator speed governing system. 10

SEAL

SECTION – D
(Electronics)

8. Answer the following sub questions :

a) Draw V-I characteristic of n-channel JFET and show on it

(i) Ohmic region (ii) Saturation region

(iii) Breakdown region (iv) Cut off region. 10

(b) What is demultiplexer ? Draw the internal logic diagram of 1 : 4 Demux. Also explain how two 1 : 4 demux can be used to implement 1 : 8 Demux. 15

(c) Design RC phase shift oscillator using op-amp for frequency of 900 Hz. State the assumption made if any. And hence draw the circuit diagram for the above operation. 15

9. Answer the following sub-questions :

(a) Explain with suitable diagram and waveform operation of full wave rectifier with centre tap transformer. 10

(b) Explain following terms in connection with op-amp. Also state their ideal and typical values of IC 741.

(i) Band width (ii) Slew rate (iii) CMRR. 15

(c) The boolean expressions of the two variables X and Y in terms of the three inputs A, B and C are given by

$X = ABC + A\overline{B}\,\overline{C} + \overline{A}B\overline{C}$

$\underline{Y} = (\overline{A} + \overline{B} + \overline{C}) \cdot (\overline{A} + B + C) \cdot (A + \overline{B} + C)$

write the relationship between X and $\underline{Y}$. 15