SID

2010

ELECTRICAL ENGINEERING - I (Optional) 100043

Standard : Degree Total Marks : 200

Nature : Conventional Duration : 3 Hours

Note :

(i) *Answers must be written in* ***English.***

(ii) *Question* ***No. 1*** *is* ***Compulsory.*** *Of the remaining questions, attempt* ***any four*** *selecting one question from* ***each section.***

(iii) *Figures to the* ***RIGHT*** *indicate marks of the respective question.*

(iv) *Make suitable assumptions, wherever be necessary and state the same.*

(v) *Number of optional questions up to the prescribed number in the order in which they have been solved will only be assessed. Excess answers will not be assessed*

(vi) *Credit will be given for orderly, concise and effective writing.*

(vii) *Candidate 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.*

1. Answer **any four** of the following.

(a) Calculate the current required by a 1500 V dc locomotive when driving a total load of 100×10^3 kg at 25 km/hr upon incline of 1 in 100. Assume tractive resistance of 0.069N/kg and efficiency of motor and gearing as 70%. **10**

(b) State the classification of resistance on the basis of value of resistance. Also state the examples of these resistances in each category. **10**

(c) A 3 phase load of 1 MW at a power factor of 0.8 lagging is supplied by a 30 kV line resistance 25 Ω and inductive reactance of 12 Ω per phase. The voltage across the load is 10 kV. A 30/10 kV transformer steps down the voltage at receiving end. The equivalent resistance and reactance of transformer as referred to 10 kV side are 0.8 Ω and 2.5 Ω respectively. Find the sending end voltage and regulation. **10**

(d) Find out how many bit A/D converter will be required to achieve a resolution of 1 mV if maximum full scale input voltage is 10 volts. **10**

(e) Explain design considerations of three phase distribution transformer. **10**

P.T.O.

Marks

SECTION - A

2. Answer the following sub-sections.

(a) Find by Thevenin's theorem current in branch A-B of the network shown in figure 1, Refer Fig 1 **10**

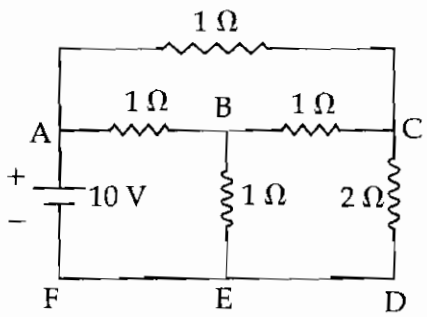

Fig. 1

(b) Obtain equation for V(x) and I(x) of a distributed parameter transmission line in generalised form. **10**

(c) (i) Explain methods of speed control of dc shunt motor. **5**

(ii) Explain working of synchronous motor under constant load and variable excitation. **15**

3. Answer the following sub-questions.

(a) A series R-L circuit with R=30Ω and L=15 H has a constant voltage applied V=60 V at t=0 through a switch. Determine the current and voltage across resistor and voltage across inductor. **10**

(b) A three phase, 60 Hz, 500 kV transmission line is 300 km long. The line inductance is 0.97 mH/km/ph and its capacitance is 0.0115 μF/km/ph. Assume a loss less line. Determine the line phase constant β, the surge impedance Z_c, velocity of propagation v and the line wavelength λ. **10**

(c) (i) Explain important features of lap winding used in dc machines. **5**

(ii) Explain necessary conditions to be fulfilled when connecting two alternators in parallel. **15**

Marks

SECTION - B

4. Answer the following sub-questions.

(a) (i) Draw the nature of Lissajous pattern obtain on CRO screen for signals applied has same frequency but 0°, 180° and 90° phase shift between them. **5**

(ii) Draw various shapes of the thermistor used in practice. **5**

(b) State the characteristics of positive and negative feedback used in feedback circuits. Also state their applications. **10**

(c) Obtain transfer function of the system whose magnitude in dB Vs log ω graph (bode plot) is shown in fig. 4(c). **10**

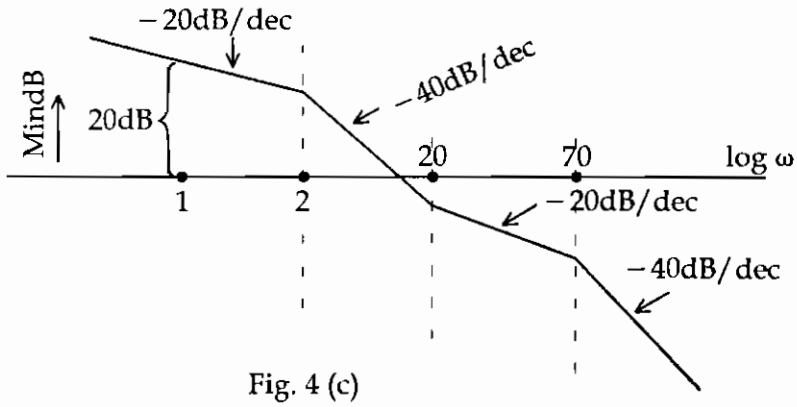

Fig. 4 (c)

(d) Consider system whose state equation is : **10**

$$\frac{dx}{dt} = AX \text{ where } A = \begin{bmatrix} -1 & 3 \\ 0 & -2 \end{bmatrix}$$

Determine eigen values and eigen vector associated with these eigen values of system.

5. Answer the following sub-questions.

(a) (i) State applications of potentiometer. **5**

(ii) Draw the connection/circuit diagram of measurement of pressure using Bourdan tube. **5**

Marks

9. (a) Draw the circuit diagram of full wave centre tap transformer rectifier feeding load R_L through capacitor filter. Also draw various waveforms observed at various test point of the circuit. **10**

(b) Design a first order low pass Butterworth Filter with cut off frequency of 15.9 kHz and a pass band gain of 1.5. **15**

(c) Explain following terms in connection with logic gate. **15**

(i) Fan In

(ii) Fan Out

(iii) Noise Immunity

(iv) Figure of merit

- o O o -

Marks

(b) For signal flow graph of system shown in Fig. 5(b) , determine overall gain of the system. **10**

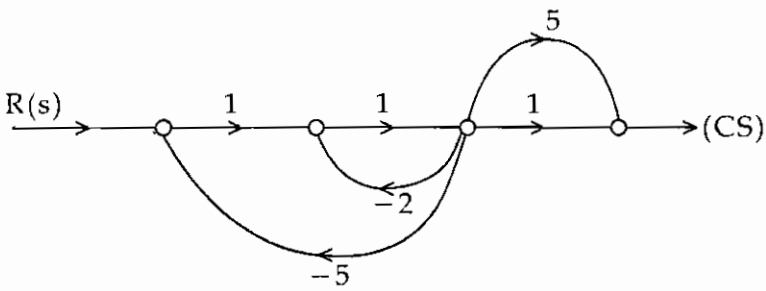

Fig. 5 (b)

(c) A system has open loop transfer function **10**

$$G(S)\,H(S) = \frac{K}{S\,(S+2)\,(S+4)\,(S+8)}$$

Determine range of 'K' for stability of the system.

(d) Draw electrical circuit/network used as lag compensator. Draw it's pole zero map/graph. Determine it's transfer function. **10**

SECTION - C

6. Answer the following sub-questions.

(a) A generator is connected through a 5 cycle circuit breaker to transformer. The generator is rated 7.5 MVA, 6.9 kV and having reactances xd'' 9% , xd' 15% and xd 100 %. If a 3 phase fault occurs on LV side of transformer, when generator is on no load estimate-. **10**

(i) Sustained short circuit current in breaker

(ii) Initial rms value of fault current

(iii) Maximum possible dc component

(iv) Current to be interrupted by the breaker

(b) Explain various arc interruption techniques for DC and AC systems. **15**

(c) (i) Draw schematics of various SVC configurations. **5**

(ii) Explain load frequency control for single area. **10**

P.T.O.

Marks

7. Answer the following sub-sections.

(a) Explain symmetrical component analysis of single line to ground fault. **10**

(b) Explain with diagram multi stage impulse generator. Draw standard impulse wave. **15**

(c) (i) State the objectives of FACTs controllers. **5**

(ii) A 5000 MW area A is interconnected with a 10000 MW area B. The parameters based on its capacity are R= 2Hz/puMW D= 0.01 puMW/ Hz Area B experiences a load increase of 100 MW. Find the static frequency drop and the change in power. **10**

SECTION - D

8. Answer the following sub-questions.

(a) State the comparison between BJT and FET. **10**

(b) Calculate output voltage V_o in terms of input voltages V_1 & V_2 for the op-amp circuit shown in the fig. 8(b) : **15**

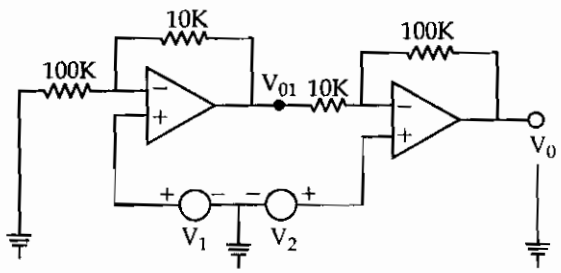

Fig. 8 (b)

(c) Simplify the following three variable expression using algebric simplification (first obtain canonical form of minterms then simplify) **15**

$Y = \Sigma m (1, 3, 5, 7)$

P.T.O.