AQU

2007

ELECTRICAL ENGINEERING - I (Optional) 100047

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 upto 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. (a) $R = 10\ \Omega$, $L = 0.2$ H and $C = 100\mu F$ are connected in series. Find the resonant frequency. If voltage of 100 V of resonant frequency is applied, calculate : (i) current, (ii) voltage drop across L and C. **10**

(b) Explain two wattmeter method for measurement of power in three phase circuit. **10**

(c) The currents in a three phase unbalanced system are : **10**

$I_R = (12 + j6)$ A; $I_Y = (12 - j12)$ A and $I_B = (-15 + j10)$ A.
Phase sequence is RYB. Calculate the positive, negative and zero sequence components of currents in the R− line.

(d) How will you classify various memory devices ? Discuss their classification. **10**

(e) Explain briefly short circuit test of a transformer ? Explain why iron losses are neglected in this test. **10**

A wattmeter reads 640 watts in a s.c. test on a transformer at rated secondary current. What will be copper losses at one fourth load ?

P.T.O.

Marks

SECTION - A

2. (a) Determine voltages at node 1 and 2 of the network shown in Fig. Q 2(a) by node voltage analysis. **10**

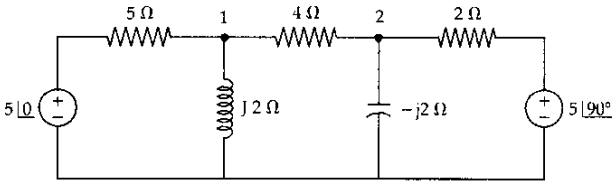

Fig. Q.2 (a).

(b) Explain and prove the Maxwell's equation for static field. **10**

$\nabla \times H = J$

$\nabla \cdot D = \rho_v$

(c) (i) Why d.c. series motor is preferred for traction application ? **5**

(ii) Enlist different methods for speed control of 3 Φ induction motors. Explain v/f control. Why is it necessary to keep v/f ratio constant ? **15**

3. (a) Calculate the open circuit impedance parameters of the given two-port network. **10**

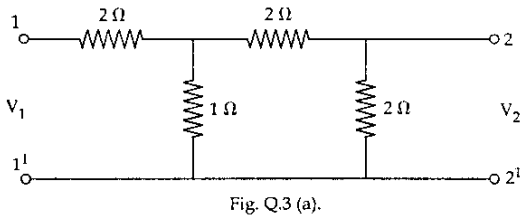

Fig. Q.3 (a).

(b) Obtain expression for reflection coefficient and transmission coefficient for normal incidence. **10**

(c) (i) What is the function of d.c. motor starter ? What is the difference between three point starter and four point starter ? **5**

(ii) Derive the condition for maximum torque under running condition. A4 pole 50 Hz, three phase induction motor has a rotor resistance of 0.21 Ω/phase and standstill reactance of 7 Ω/phase. Calculate the speed at which maximum torque is produced ? **15**

Marks

SECTION - B

4. (a) (i) Draw a well labelled diagram of a cathode ray tube. 5

(ii) A strain gauge is bonded to a beam 0.1 m long and has a cross sectional area of 4 cm^2. Young's modulus for steel is 207 GN/m^2. The strain gauge has a unstrained resistance of 240 Ω and a gauge factor of 2.2. When a load is applied, the resistance of the gauge changes by 0.013 Ω. Calculate the change in the length of the steel beam and amount of force applied to the beam. 5

(b) A certain control system is represented by block diagram given Fig. Q 4 (b). Determine C (s)/R (s) 10

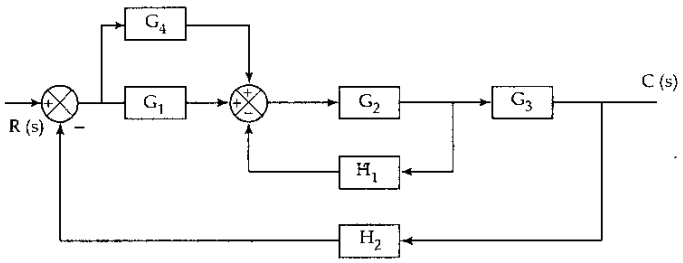

Fig. Q. 4 (b).

(c) Determine the time response and stability of the system whose close loop pole is located at $s = -a$, where $a>0$ and is real. System has unity feedback and input is step. 10

(d) Enlist the names of all industrial controllers and explain proportional controller. 10

5. (a) (i) With the help of diagram explain in brief construction of LVDT. 5

(ii) Briefly explain working of digital frequency counter with schematic block diagram. 5

(b) Enlist the rules of block diagram algebra and show that 10

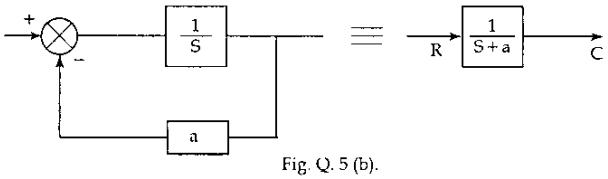

Fig. Q. 5 (b).

(c) Write advantages and disadvantages of Routh's criterion and find how many roots have real part greater than -1, for $s^3+7s^2+25s+39=0$ 10

(d) Explain PI controllers and give its features. 10

P.T.O.

Marks

SECTION - C

6. (a) What is synchronous phase modifier ? Explain in brief. **10**

(b) What is meant by a relay ? What are the fundamental requirements of a relay ? What is IDMT characteristics ? What is meant by directional feature of directional over-current relay ? What is a static relay ? What are its advantages ? **15**

(c) (i) What are the advantages of H.V.D.C. transmission ? **5**
(ii) Enlist and explain the equipments for automatic control of frequency. **10**

7. (a) A 3Φ, 11 kV, 10 MVA alternator has sequence reactances of $X_0 = 0.05$ p.u., $X_1 = 0.15$ p.u., and $X_2 = 0.15$ p.u.. If the generator is on no load, find the ratio of fault currents for L-G fault to that when all the 3 phases are dead short-circuited. **10**

(b) What do you mean by : **15**
(i) Recovery voltage, (ii) Restriking voltage, and (iii) RRRV
With respect to circuit breaker. Explain the working of SF_6 circuit breaker. What are its advantages and limitations.

(c) (i) Enlist different methods employing static devices to compensate reactive power requirement. **5**
(ii) Explain functions of load dispatch. **10**

SECTION - D

8. (a) Explain in brief the working of enhancement type n-channel MOSFET with the help of structural diagram. Compare MOSFET with BJT. **10**

(b) Draw a circuit diagram of a push-pull amplifier. Explain its operation. Discuss the advantages and disadvantages. **15**

(c) State and prove DeMorgan's Theorem. **15**

9. (a) Draw a neat diagram of 1 Φ, full wave rectifier using midpoint configuration. Draw output voltage waveform. Derive for Vdc, Vrms and form factor. **10**
A full wave rectifier supplies a load of 1 kΩ. The a.c. voltage applied to rectifier is 200-0-200 Vrms. Neglecting diode resistance, calculate :
(i) average d.c. output voltage. (ii) ripple voltage r.m.s.
(iii) PIV across diode.

(b) What are the advantages of integrated circuits ? Describe the function of op-amp. as (i) inverter, (ii) differentiator and (iii) adder. **15**

(c) (i) Find binary equivalent of 576. **5**
(ii) Enlist and explain different digital logic families. **10**

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