G 1628 (Pages : 3) Reg. No.................................

Name..................................

B.TECH. DEGREE EXAMINATION, MAY 2018

Fourth Semester

Branch : Electrical and Electronics Engineering

EE 010 402—DC MACHINES AND TRANSFORMERS (EE)

(New Scheme—2010 Admission onwards)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. What are compensating windings ? What is their most serious disadvantage ?
2. What are the conditions of self-excitation of a d.c. shunt generator ?
3. What happens in a d.c. shunt motor if its field circuit opens while it is running ?
4. What are the losses that occur in a transformer ? What precautions are taken to minimize these losses ?
5. Show that in a system of three star-connected transformers no third harmonic appears in the line voltages.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Derive from first principles the e.m.f. equation of a d.c. generator. State the assumptions made.
7. Draw typical load characteristics of d.c. (i) Shunt ; (ii) Series ; and (iii) Compound generators.
8. Explain a suitable method for speed control of a d.c. shunt motor. The speed variations are to be in the range of zero to rated speed.
9. State and prove the conditions under which a transformer operates at its maximum efficiency.
10. Explain with diagrams how two-phase supply can be derived from a 3-phase supply.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. (a) Obtain an expression for cross magnetising and demagnetising ampere turns per pole in D.C. generator with a brush lead of θ° and P poles.

(6 marks)

(b) Determine per pole the number of :

(i) Cross ampere turns. (2 marks)

(ii) Back ampere turns. (2 marks)

(iii) Series turns to balance the back ampere turns in the case of a D.C. generator having the following data :

Number of conductors = 800

Total current = 200 A

6-pole, 2 circuit wave winding

Angle of lead = 10°

Leakage coefficient = 1.3.

(2 mark)

Or

12. Define commutation and briefly discuss various methods of commutation in D.C. machine. Explain about various methods to improve commutation.

13. A long shunt compound D.C. generator delivers a load of 15 kW at 500 V. The armature, series and shunt field resistances are 0.05 Ω, 0.03 Ω, and 200 Ω respectively. Calculate the generated voltage and total copper losses in the machine. Allow brush contact drop of 1 volt per brush.

Or

14. (a) Explain power flow diagram in D.C. generator. (6 marks)

(b) A d.c. shunt generator is developing rated terminal voltage at some speed. Will the generator build up voltage ;

(i) If only the direction of rotation is reversed ; (2 marks)

(ii) If the field connections are reversed ; and (2 marks)

(iii) If both the direction of rotation and the field windings connections are reversed ?

(2 marks)

15. A 75 kW, 500 V, D.C. shunt motor has 4 poles and wave connected armature of 492 conductors. Flux per pole is 0.05 Weber and full load efficiency is 92 %. Armature circuit resistnce is 0.1 Ω, and shunt field resistance is 250 Ω. Calculate for full load (a) the speed ; (b) useful torque.

(6 + 6 = 12 maks)

Or

16. (a) Using block diagram, explain solid state speed control of D.C. motor. (6 marks)

(b) A 220 V D.C. shunt motor has an armature resistance of 0.5 Ω and takes a current of 40 A on full-load. By how much must the main flux be reduced to raise the speed by 50 % if the developed torque is constant ?

(6 marks)

17. (a) Explain how the efficiency and regulation of a transformer can be pre-determined from the O.C. and S.C. test readings.

(6 marks)

(b) A 250/500 V transformer gave the following test results :

S.C. test : (L.V. winding short circuited);

20 V, 12 A, 100 W.

O.C. test :250 V, 1 A, 80 W on L.V. side

Determine the circuit constants and represent them on the equivalent circuit.

(6 marks)

Or

18. (a) Draw and explain the phasor diagram of transformer for capacitive load. (6 marks)

(b) Explain with connection diagram the Sumpner method of testing a pair of transformers. What are the advantages and disadvantages of this method over S.C. and O.C. test methods of calculating the performance results ?

(6 marks)

19. A three-phase step down transformer is connected to 6600 V mains and takes 10 A. Calculate secondary line voltage, line current and output for the following connections :

(i) Mesh/mesh. (3 marks)

(ii) Star/star. (3 marks)

(iii) Mesh/star. (3 marks)

(iv) Star/mesh. (3 marks)

Turns ratio per phase is 12.

Or

20. (a) A distribution transformer has its maximum efficiency of 98 % at 15 kVA, unity power factor. During the day it is loaded as follows :

12 hours	2 kW at 0.5 P.F. lead
6 hours	12 kW at 0.8 P.F. lag
6 hours	18 kW at 0.9 P.F. lag

Determine the all day efficiency.

(6 marks)

(b) What are the advantages and disadvantages of auto transformers ? Compare the weights of copper used in an Auto Transformer and a two winding transformer.

(6 marks)

[5 × 12 = 60 marks]

G 1635 (Pages : 4) Reg. No.................................

Name.................................

B.TECH. DEGREE EXAMINATION, MAY 2018

Fourth Semester

Branch : Electrical and Electronics Engineering

EE 010 403—LINEAR SYSTEM ANALYSIS (EE)

(New Scheme—2010 Admission onwards)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each full question carries 3 marks.

1. Differentiate between Linear time invariant and Time variant systems.
2. Define state, state vector, state variables and state space.
3. Define the following as applied to second order system :
   (i) Rise time.
   (ii) Settling time.
   (iii) Peak overshoot.
4. State Routh-Hurwitz criterion for a system to be stable.
5. Define z-parameters for a two-port network.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each full question carries 5 marks.

6. Derive the transfer function $\frac{\theta(s)}{E(s)}$ of armature controlled D.C. motor where $\theta(s)$ is agular displacement of the motor shaft and E(s) is the applied voltage.

7. Find the transfer function $\frac{Y_6}{Y_1}$ using Mason's gain formula for the signal flow graph shown in Fig. 1.

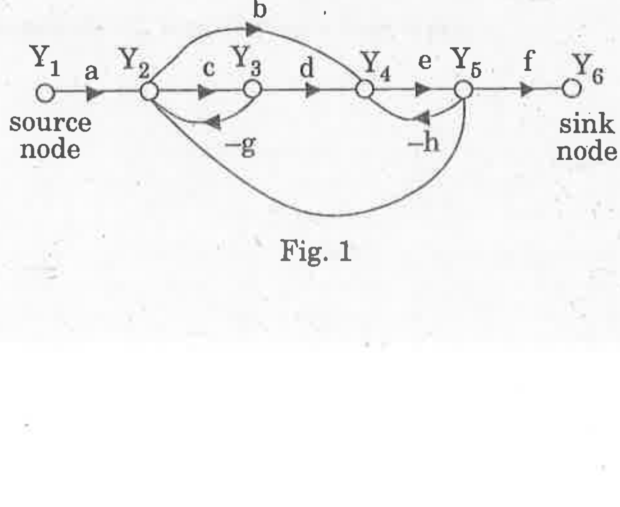

Fig. 1

Turn over

8. A unity feedback system has

$$G(s) = \frac{40(s+2)}{s(s+1)(s+4)}$$

Determine type of the system, error coefficients and steady state error for input $r(t) = 4t$.

9. The characteristic equation of the system is given by $s^6 + 3s^5 + 4s^4 + 6s^3 + 5s^2 + 3s + 2 = 0$:

   (a) Examine the stability. (3 marks)

   (b) Also determine the number of roots present in the RHS plane. (2 marks)

10. The circuit of a bridged-T network is shown in Fig. 2. Determine the transfer function $\frac{V_o(s)}{V_i(s)}$ of the network.

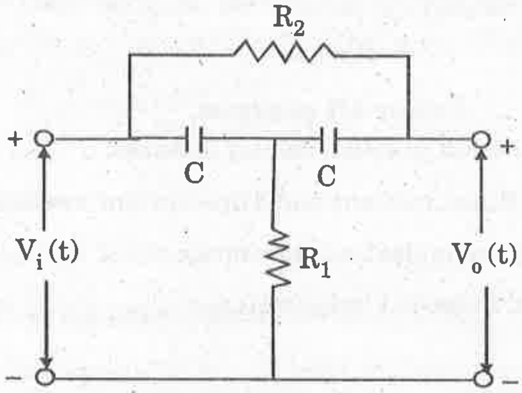

Fig. 2

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*

Each full question carries 12 *marks.*

11. (a) Discuss Mathematical modelling of a mechanical translational and rotational system. (6 marks)

    (b) Explain how linearization of a non-linear model is done. (6 marks)

Or

12. Explain the procedure of linearizing the non-linear models of electrical systems and linearize the non-linear equation Z = XY in the region $5 \le X \le 7$, $10 \le Y \le 12$. Find the error if the linearized equation is used to calculate the value of Z when X = 5, Y = 10.

13. Draw the signal flow graph for the system of equations given below and obtain the transfer function $\frac{Y_5}{Y_1}$.

$$y_2 = a_{12}y_1 + a_{32}y_3$$
$$y_3 = a_{23}y_2 + a_{43}y_4$$
$$y_4 = a_{24}y_2 + a_{34}y_3 + a_{44}y_4$$
$$y_5 = a_{25}y_2 + a_{45}y_4$$

Or

14. (a) For the speed control system shown in Fig. 3, determine the closed loop transfer function $\frac{W(s)}{E_i(s)}$ by block diagram reduction method, where W is the load speed.

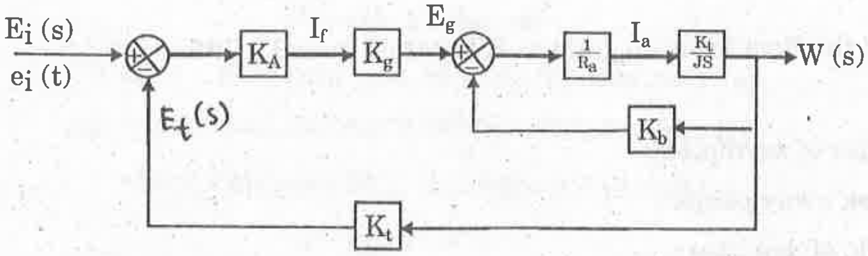

Fig. 3

(6 marks)

(b) With the system shown in Fig. 3 above originally at rest, a control voltage $e_i(t)$ = 100 V is suddenly applied. Determine how the load speed will change with time.

Given : K_A = 4 amp/volt

K_g = 50 volts/amp

R_a = 1 Ω

K_T = 1.5 Newton-m/amp

K_t = 0.2 volts per rad/sec.

J = 6 kg.-m.^{2}

(Hint : $K_b = K_T$ in MKS units).

(6 marks)

15. The response of a system to a unit step is $C(t) = 1 - 1.25\, e^{-2t} + 0.25\, e^{-10t}$. Determine the transfer function of the system and also its response to a unit ramp input.

Or

16. For a unity feedback system having an open loop transfer function :

$$G(s) = \frac{1}{s(s+1)}$$

Determine :

(i) Damping ratio. (3 marks)

(ii) Undamped natural frequency. (3 marks)

(iii) Peak time. (3 marks)

(iv) Maximum overshoot, considering a step input. (3 marks)

17. Investigate the stability of the closed loop system for the loop transfer function

$$G(s)\,H(s) = \frac{K}{s(s+2)\left(s^2+2s+10\right)}$$

by sketching the Root locus diagram as K is varied from 0 to infinity. (4 marks)

Find :

(i) Angles of asymptotes. (2 marks)

(ii) Break away points. (2 marks)

(iii) Angle of departure. (2 marks)

(iv) Using the root locus diagram, the value of K when the system is critically stable. Also the corresponding closed loop transfer function given $H(s) = 1$. (2 marks)

Or

18. State Lyapunov's theorem. (3 marks)

Compare direct and indirect methods of Lyapunov's theorem. (3 marks)

Explain stability analysis using Lyapunov's direct method. (6 marks)

19. For the two-port network shown in Fig. 4, Find the transfer function $G_{21}(s)$ and $Z_{21}(s)$ and the driving point and admittance $Y_{11}(s)$.

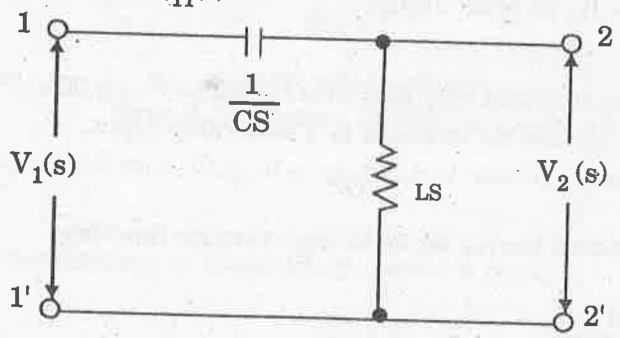

Fig. 4. Two-Port Network

Or

20. Write notes on the following :—

(a) Ideal transformer. (4 marks)

(b) Gyrator. (4 marks)

(c) Negative Impedance Converter (NIC). (4 marks)

[5 × 12 = 60 marks]

G 1647

(Pages : 3)

Reg. No...............................

Name...................................

B.TECH. DEGREE EXAMINATION, MAY 2018

Fourth Semester

Branch : Electrical and Electronics Engineering

EE 010 404—ELECTROMAGNETIC THEORY (EE)

(New Scheme—2010 Admission onwards)

[Supplementary]

Time : Three Hours

Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. What is a unit vector ? How to find unit vector along a particular vector ?
2. What is an electric dipole ? Explain.
3. Describe electrical image. What is its use ?
4. Enlist the Maxwell's equations for static fields.
5. What is time average power flow ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Give the Cartesian co-ordinates of the vector field $\overline{H} = 20\overline{a}_r - 10\overline{a}_\phi + 3\overline{a}_z$, at point P ($x = 5, y = 2, z = -1$).
7. A scalar potential is given by $V = 5x + 4y^2 + 2z^3$. Find $\overline{E}$ at (2, 3, 4).
8. Calculate the capacitance of a conducting sphere of 2 cm. diameter, covered with a layer of polyethelene having $\epsilon_r = 2.26$ and 3 cm. thick.
9. Calculate the inductance of a toroid formed by surfaces $\rho = 3$ cm. and $\rho = 5$ cm. $z = 0$ and $z = 1.5$ cm. wrapped with 5000 turns of wire and filled with a magnetic material with $\mu_r = 6$.
10. A two-dimensional electric field is given by $\overline{E} = x^2\overline{a}_x + x\overline{a}_y$ volt/m. Show that this electric field cannot arise from a static distribution of charge.

(5 × 5 = 25 marks)

Turn over

Part C

*Answer **all** questions.*
Each full question carries 12 marks.

11. (a) State and prove Gauss's law. (5 marks)

(b) A 2 μC charge is located at (0, 3, 0) mt and a 4 μC charge is at (4, 0, 0) mt. Determine E at (0, 0, 5) mt.

(7 marks)

Or

12. (a) Explain the concept of divergence in a cartesian co-ordinate system. (6 marks)

(b) If $\overline{D} = 9x^3\hat{x} + 5y^2\hat{y} + 2z\hat{z}$ C/mt², find the charge density at the point (1, 5, 9) mt.

(6 marks)

13. (a) Determine the electric field intensity of an infinitely long, straight line charge of a uniform density λ in air.

(6 marks)

(b) In a certain region, the potential is given by $V = (x^2 + 3y^2 + 9z)$. Find the electric field intensity at point P (1, – 2, 3) mt.

(6 marks)

Or

14. (a) Derive Laplace's and Poisson's equations in relation with electrostatic field. (6 marks)

(b) A charge Q is distributed uniformly over the wall of a circular tube of radius "b" and height "h". Find the potential V and field intensity E at a point inside the tube on its axis.

(6 marks)

15. A parallel plate capacitor with a separation of 1 cm. has 29 kV applied, when air was the dielectric used. Assume that the dielectric strength of air as 30 kV/cm. A thin piece of glass with $\epsilon_r = 6.5$ with a dielectric strength of 290 kV/cm. with thickness 0.2 cm. is inserted. Find whether glass will break or air ? Why ?

Or

16. (a) Explain the condition at the boundary between two dielectrics. (6 marks)

(b) A parallel plate capacitor of 10 cm. × 10 cm. and d = 1 cm. is charged to a potential of 1 kV with air as dielectric. Find the energy stored.

(6 marks)

17. (a) Develop an expression for torque on a closed magnetic circuit. (5 marks)

(b) A solenoid with air core has 2000 turns and a length of 500 mm., core radius is 40 cm. Find its inductance. Derive the formula used.

(7 marks)

Or

18. (a) Derive an expression for curl of magnetic field intensity and prove Stroke's theorem.

(8 marks)

(b) Derive the expression for inductance of a torroidal ring with N turns, area of cross-section A and diameter d, if placed in air.

(4 marks)

19. (a) Starting with Maxwell's equations, derive an expression for wave equation in $\overline{H}$ for uniform plane waves in a conducting medium for sinusoidal time variations of the fields.

(6 marks)

(b) A coaxial line has an inner conductor of diameter 0.5 cm. and outer conductor of diameter 2 cm. The outer conductor is grounded. The inner conductor is held at 200 volts and carries a current of 10 amperes. Obtain the Poynting vector.

(6 marks)

Or

20. (a) A voltage of 100 sin 500 t is applied to a capacitor of 1 μF. Find the value of displacement current at $t = 1$ m. sec.

(4 marks)

(b) A plane wave is incident normally on a large sheet of copper. If the frequency and peak $\overline{E}$ of the incident wave is 100 MHz and 1 V/m respectively, find the power absorbed per unit area by the copper sheet.

(8 marks)

[5 × 12 = 60 marks]

G 1659 (Pages : 2) Reg. No..............................

Name..................................

B.TECH. DEGREE EXAMINATION, MAY 2018

Fourth Semester

Branch : Electrical and Electronics Engineering

EE 010 405—DIGITAL SYSTEMS AND COMPUTER ORGANIZATION (EE)

(New Scheme—2010 Admission onwards)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. State and prove cummulative laws.
2. Compare asynchronous and synchronous counter.
3. What are the applications of universal shift register ?
4. What actions take place while executing instruction ?
5. Explain the term memory latency and bandwidth.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Reduce using mapping the expression $f = \sum m\,(2, 3, 6, 7, 8, 10, 11, 13, 14)$.
7. Explain edge-triggered D flip-flop.
8. Explain synchronous UP/DOWN counters.
9. Explain full adder with neat diagram.
10. Explain how program controlled I/O is performed using polling.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. Explain the following :

    (a) BCD-to-Seven Segment Decoders. (b) 1-Line-to-8-Line Demultiplexer.

Or

12. Explain Transistor Logic in detail
13. Explain the master-slave S-R and J-K flip-flops.

Or

14. Discuss the effects of propagation delay in Ripple counter
15. Explain SISO and PISO with neat diagram

Or

16. Explain Ring and Johnson counter with diagrams.
17. Explain the following :

    (a) Block diagram of a processor. (b) Three bus structure

Or

18. Explain how to reduce delay using augmented logic gate ?
19. Explain cache memory mapping techniques.

Or

20. Explain Peripheral Component Interconnect (PCI) bus in detail.

(5 × 12 = 60 marks)