IV EC, EE (S)

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10MAT41

Fourth Semester B.E. Degree Examination, June/July 2015
Engineering Mathematics - IV

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART - A

1 a. Obtain y(0.2) using Picards method upto second iteration for the initial value problem $\frac{dy}{dx} = x^2 - 2y \quad y(0) = 1.$ **(06 Marks)**

b. Solve by Eulers modified method to obtain y(1.2) given $y' = \frac{y+x}{y-x} \quad y(1) = 2.$ **(07 Marks)**

c. Using Adam Bash forth method obtain y at x = 0.8 given **(07 Marks)**
$\frac{dy}{dx} = x - y^2$, $y(0) = 0$, $y(0.2) = 0.02$, $y(0.4) = 0.0795$ and $y(0.6) = 0.1762$.

2 a. Solve by 4th order Runge Kutta method simultaneous equations given by $\frac{dx}{dt} = y - t$, $\frac{dy}{dt} = x + t$ with $x = 1 = y$ at $t = 0$, obtain y(0.1) and x(0.1). **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2} - x\left(\frac{dy}{dx}\right)^2 + y^2 = 0$, $y(0) = 1$, $y'(0) = 0$. Evaluate y(0.2) correct to four decimal places, using Runge Kutta method of fourth order. **(07 Marks)**

c. Solve for x = 0.4 using Milnes predictor corrector formula for the differential equation y'' + xy' + y = 0 with y(0) = 1 , y(0.1) = 0.995 , y(0.2) = 0.9802 and y(0.3) = 0.956. Also z(0) = 0 , z(0.1) = -0.0995 , z(0.2) = -0.196 , z(0.3) = -0.2863. **(07 Marks)**

3 a. Verify whether f(z) = sin2z is analytic, hence obtain the derivative. **(06 Marks)**

b. Determine the analytic function f(z) whose imaginary part is $\frac{y}{x^2 + y^2}$. **(07 Marks)**

c. Define a harmonic function. Prove that real and imaginary parts of an analytic function are harmonic. **(07 Marks)**

4 a. Under the mapping $w = e^z$, find the image of i) $1 \le x \le 2$ ii) $\pi/3 < y < \frac{\pi}{2}$. **(06 Marks)**

b. Find the bilinear transformation which maps the points 1, i, -1 from z plane to 2, i, -2 into w plane. Also find the fixed points. **(07 Marks)**

c. State and prove Cauchy's integral formula. **(07 Marks)**

PART - B

5 a. Prove $J_n(x) = \frac{x}{2n}[J_{n-1}(x) + J_{n+1}(x)]$. **(06 Marks)**

b. Prove $(n+1) P_n(x) = (2n+1) x P_n(x) - n P_{n-1}(x)$. **(07 Marks)**

c. Explain the following in terms of Legendres polynomials.
$x^4 + 3x^3 - x^2 + 5x - 2$ **(07 Marks)**

6 a. A class has 10 boys and 6 girls. Three students are selected at random one after another. Find the probability that i) first and third are boys , second a girl ii) first and second are of same sex and third is of opposite sex. **(06 Marks)**

b. If $P(A) = 0.4$, $P(B/A) = 0.9$, $P(\overline{B}/\overline{A}) = 0.6$. Find $P(A/B)$, $P(A/\overline{B})$. **(07 Marks)**

c. In a bolt factory machines A, B and C manufacture 20%, 35% and 45% of the total of their outputs 5%, 4% and 2% are defective. A bolt is drawn at random found to be defective. What is the probability that it is from machine B? **(07 Marks)**

7 a. A random variable x has the following distribution :

x :	-2	-1	0	1	2	3	4
P(x) :	0.1	0.1	k	0.1	2k	k	k

Find k, mean and S.D of the distribution. **(06 Marks)**

b. The probability that a bomb dropped hits the target is 0.2. Find the probability that out of 6 bombs dropped i) exactly 2 will hit the target ii) atleast 3 will hit the target. **(07 Marks)**

c. Find the mean and variance of the exponential distribution. **(07 Marks)**

8 a. A die is tossed 960 times and 5 appear 184 times. Is the die biased? **(06 Marks)**

b. Nine items have values 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of these differ significantly from assumed of mean of 47.5. ($\gamma = 8$, $t_{0.05} = 2.31$). **(07 Marks)**

c. A set of 5 similar coins tossed 320 times gives following table.

No. of heads :	0	1	2	3	4	5
Freq.	6	27	72	112	71	32

Test the hypothesis that data follows binomial distribution (Given $\gamma = 5$, $\chi^2_{0.05} = 11.07$) **(07 Marks)**

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10ES42

Fourth Semester B.E. Degree Examination, June/July 2015
Microcontrollers

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting atleast TWO questions from each part.***
2. Include suitable comments to your programs.

PART – A

1 a. Compare 8051, 8052 and 8031 microcontrollers. **(05 Marks)**

b. Explain the internal RAM section of 8051 μc with required diagrams. **(10 Marks)**

c. For the following μc ICS, determine the ROM memory address of AT89C51 with 4KB, DS89C420 with 16 KB and DS5000 with 32KB. **(05 Marks)**

2 a. What are the merits and demerits of indirect addressing mode? **(05 Marks)**

b. State the type of addressing mode used for the following instructions :
i) ADD A, 30h,
ii) CJNE A, #29h, AGHAIN
iii) INC @ R0
iv) XCH A, R3
v) CLR C. **(05 Marks)**

c. Explain the working of DAA instruction with an example. Assume that data is 99h and 99h. **(05 Marks)**

d. Write a program to covert hexadecimal number to decimal. Include suitable comments. **(05 Marks)**

3 a. Write a program to load accumulator with the value 55h and complement the content of accumulator 900 times. **(05 Marks)**

b. For AT89C51, with a crystal frequency of 22 MHz, write a program to generate a delay of 5 ms. **(05 Marks)**

c. Explain the working of JZ LABEL instruction with an example. Is zero flag present in 8051? **(05 Marks)**

d. Explain the calculation of checksum byte in ROM with an example. **(05 Marks)**

4 a. Explain the features of ADC 0804. Also explain the working of its various pins. **(10 Marks)**

b. Explain the principle of stepper motor. Write a program to rotate motor 64° in clockwise direction. The motor has step angle of 2°. Write the 4 step sequence also. The motor has steps per revolution = 180, number of rotor teeth = 45, movement per 4 step sequence = 8°. **(10 Marks)**

PART – B

5 a. Explain the bit status of TMOD special function resister. Also, explain its various modes. **(05 Marks)**

b. Using P1.5, timer – 1 in mode – 1, write a program to generate the following waveform as shown in Fig. Q5(b). Assume that system clock is 11.0592 MHz. Show the delay calculations. This waveform should be generated continuously. **(10 Marks)**

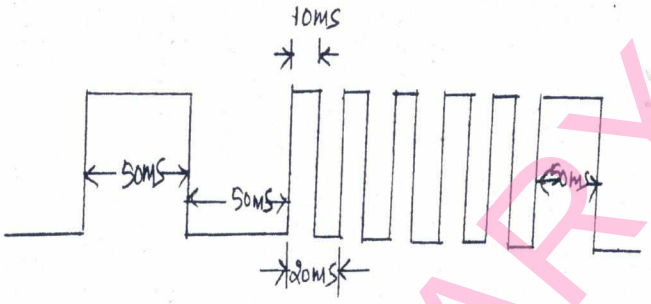

Fig.Q5(b)

c. Write a 'C' program that continuously gets a single bit of data from P1.7 and sends it to P1.0, while simultaneously creating a square wave of 200 μs period on pin P2.5. Use timer – 0 to create the square wave. Assume that crystal is 11.0592 MHz. **(05 Marks)**

6 a. Explain the bit status of SCON special function register. **(05 Marks)**

b. Write a 'C' program for 8051 to transfer the letter 'A' serially at 4800 baud continuously. Use 8 – bit data and 1 stop bit. Use timer 1 in mode 2. **(05 Marks)**

c. Determine the baud rate if THI = –2, SMOD = 1, XTAL = 11.0592 MHz. Is this baud rate supported by IBM PCS? **(05 Marks)**

d. Calculate the control word of 8255 for the following cases :
   i) All the ports A B and C are output ports (mode – 0)
   ii) PA = in, PB = out, PCL = out = PCH. **(05 Marks)**

7 a. Explain the expansion of MSP μc. Also explain how MSP μc is different from conventional μc, with an example. **(08 Marks)**

b. Explain the differences between MSP430XIXX, MSP430F2XX, MSP430X3XX, MSP430X4XX and MSP 430X μcs. **(08 Marks)**

c. Explain the salient features of MSP430μc. **(04 Marks)**

8 a. Explain the functions of watchdog timer, basic timer – 1, real time clock, timer A and timer B in MSP430μc. **(10 Marks)**

b. Explain the interfacing of LCD to MSP430μc. **(10 Marks)**

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10ES43

Fourth Semester B.E. Degree Examination, June/July 2015
Control Systems

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. With the help of neat block diagram, define open loop and closed loop control system. **(04 Marks)**

b. For a mechanical system shown in Fig.Q1(b) obtain force voltage analogous electrical network. **(08 Marks)**

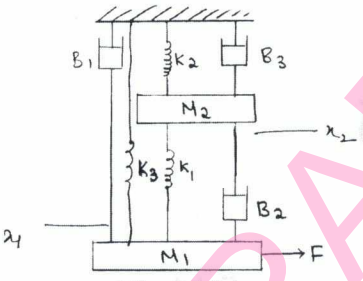

Fig.Q1(b)

c. Draw the electrical network based on torque current analogy and give all the performance equation for the Fig.Q1(c). **(08 Marks)**

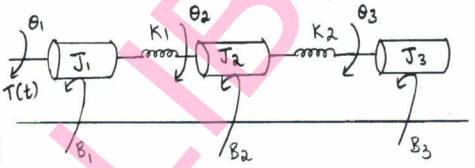

Fig.Q1(c)

2 a. Define the following terms related to signal flow graph with a neat schematic :
i) Forward path ii) Feedback loop iii) Self loop iv) Source node. **(04 Marks)**

b. Obtain the transfer function for the block diagram, shown in Fig .Q2(b). Using :
i) Block diagram reduction technique ii) Mason's gain formula. **(08 Marks)**

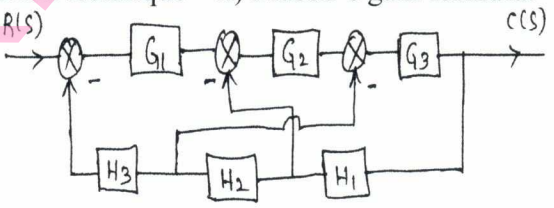

Fig.Q2(b)

c. For the signal flow graph shown in Fig. Q2(c), find the overall transfer function by :
i) Block diagram reduction technique
ii) Verify the result by mason's gain formula. **(08 Marks)**

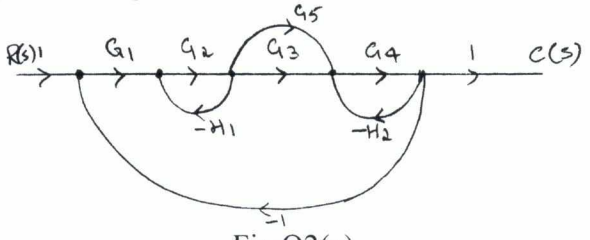

Fig.Q2(c)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

3 a. Define and derive the expression for : i) Rise time ii) Peak overshoot of an under-damped second order control system subjected to step input. **(06 Marks)**

b. For a unit feedback control system with : $G(s)=\frac{10(s+2)}{s^2(s+1)}$, Find : i) The static error coefficients ii) Steady state error when the input is $R(s)=\frac{3}{s}-\frac{2}{s^2}+\frac{1}{3s^3}$. **(06 Marks)**

c. A system is given by differential equation $\frac{d^2y}{dt^2}+4\frac{dy}{dt}+8y=8x$, where y = output and x = input. Determine : i) Peak overshoot ii) Settling time iii) Peak time for unit step input. **(08 Marks)**

4 a. Explain Routh – Hurwitz criterion for determining the stability of the system and mention its limitations. **(06 Marks)**

b. For a system $s^4 + 22s^3 + 10s^2 + s + k = 0$, find K_{mar} and ω at K_{mar}. **(06 Marks)**

c. Determine the value of 'k' and 'b' so that the system whose open loop transfer function is : $G(s)=\frac{k(s+1)}{s^3+bs^2+3s+1}$ oscillates at a frequency of oscillations of 2 rad/sec. **(08 Marks)**

PART – B

5 a. For a unity feedback system, the open loop transfer function is given by:

$$G(s)=\frac{K}{s(s+2)(s^2+6s+25)}$$

i) Sketch the root locus for $0 \le k \le \infty$ ii) At what value of 'k' the system becomes unstable iii) At this point of instability, determine the frequency of oscillations of the system. **(15 Marks)**

b. Consider the system with $G(s)H(s)=\frac{k}{s(s+2)(s+4)}$, find whether s = -0.75 is point on root locus or not using angle condition. **(05 Marks)**

6 a. Explain the procedure for investigating the stability using Nyquist criterion. **(05 Marks)**

b. For a certain control system : $G(s)H(s)=\frac{k}{s(s+2)(s+10)}$. Sketch the Nyquist plot and hence calculate the range of values of 'k' for stability. **(15 Marks)**

7 a. Sketch the bode plot for the open loop transfer function :

$G(s)H(s)=\frac{k(1+0.2s)(1+0.025s)}{s^3(1+0.001s)(1+0.005s)}$, Find the range of 'k' for closed loop stability. **(14 Marks)**

b. Define the following as applied to bode plots :
i) Gain margin ii) Phase margin iii) Gain and phase cross over frequency. **(06 Marks)**

8 a. Define the following terms : i) State ii) State variable iii) State space iv) State transition. **(04 Marks)**

b. A system is described by the differential equation, $\frac{d^3y}{dt^3}+\frac{3d^2y}{dt^2}+\frac{17dy}{dt}+5y=10u(t)$, where 'y' is the output and 'u' is input to the system. Determine the state space representation of the system. **(06 Marks)**

c. Obtain the state equations for the electrical network shown in Fig. Q8(c). **(10 Marks)**

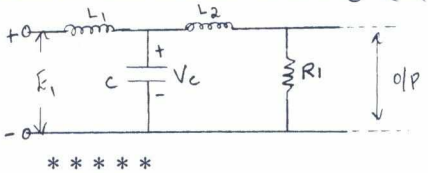

Fig.Q8(c)

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10EE44

Fourth Semester B.E. Degree Examination, June/July 2015
Field Theory

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Define electric field intensity at a point. A point charge of 6 μc is located at (0, 0, 1), the uniform line charge of density e_L = 180 nC/m is along x – axis and uniform sheet charge with e_s = 25 nC/m^2 over the plane z = –1. Find the combined elastic field intensity at p(1, 5, 2) due to all the charges. **(08 Marks)**

b. Derive differential form of Gauss's law. **(06 Marks)**

c. Let $\vec{D} = 5r^2 \hat{a}_r \quad D < r < 0.08m$

$$= \frac{0.1}{r^2} \hat{a}_r \quad \text{for } r > 0.08m$$

i) Find the charge density for r = 0.06 m
ii) Find the charge density for r = 0.1 m. **(06 Marks)**

2 a. Derive the relation between electric field intensity and electric potential. **(06 Marks)**

b. Explain the boundary conditions for a boundary between two electric materials. **(08 Marks)**

c. If V = x – y + xy + zy volts, find the electric field intensity at a point (1, 2, 3) and the energy stored in a cube of scale 2m. **(06 Marks)**

3 a. Derive Poisson's and Laplace's equations. **(04 Marks)**

b. Solve the Laplace and equation for the potential field in the homogenous region between the two concentric conducting spheres with radii 'a' and 'b' (a < b). The potential v = 0 at r = b and v = v_0 at r = a. Also find the capacitance between them. **(10 Marks)**

c. State and prove uniqueness theorem. **(06 Marks)**

4 a. State Biot-Savart law and use it to obtain the magnetic flux density at a point on the axis of a current carrying solenoid. **(06 Marks)**

b. Derive the expression $\nabla \times \vec{H} = \vec{J}$ **(08 Marks)**

c. Given the field $\vec{H} = \frac{x + 2y}{z^2} \hat{a}_y + \frac{2}{z} \hat{a}_x$ A/m. find the total current passing through the surface z = 4 ; 1 < x < 2 ; 3 < y < 5. **(06 Marks)**

PART – B

5 a. Explain the boundary conditions between two magnetic materials. **(08 Marks)**

b. Derive an expression for vector magnetic potential. **(06 Marks)**

c. Calculate the inductance of a solenoid of 200 turns wound tightly on a cylindrical tube of length 60 cms and of diameter 6 cms. Derive the expression used. **(06 Marks)**

6 a. Derive the point form Faraday's law. **(08 Marks)**

b. Do the fields $\vec{E} = E_m \sin x \sin t \ \hat{a}_y$ V/m

and $\vec{H} = \frac{E_m}{\mu_0} \cos x \cos t \ \hat{a}_z$ A/m satisfy Maxwell's equations. **(06 Marks)**

c. Establish the equivalence of conduction current and displacement current. **(06 Marks)**

7 a. Derive the relation between $\vec{E}$ and $\vec{H}$ for a uniform plane wave propagating in a conducting medium. **(08 Marks)**

b. Derive expressions for attenuation constant (α) and phase constant (β) for an electromagnetic wave. **(06 Marks)**

c. A uniform plane wave $E_y = 10 \sin (2\pi \times 10^8 t - \beta x)$ V/m is propagating in x – direction. Find the phase constant, phase velocity and the magnetic field component. **(06 Marks)**

8 a. State and prove Poynting's theorem. **(08 Marks)**

b. Determine the amplitude of reflected and transmitted fields (both E and H) at the interface of two dielectric regions. Given E_i = 1.5 mV/m in region – 1, $\epsilon_{r_1} = 1$, $\mu_{r_1} = 1$; $\epsilon_{r_2} = 8.5$, $\mu_{r_2} = 1$. **(06 Marks)**

c. Write a short note on standing wave ratio (SWR). **(06 Marks)**

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10EE45

Fourth Semester B.E. Degree Examination, June/July 2015
Power Electronics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. With a neat circuit and waveforms of control signal and output voltage, explain the control characteristics of IGBT and SCR. **(08 Marks)**

b. Explain briefly the different types of thyrister power converter and mention two applications of each and also specify the form of input and output waveforms. **(12 Marks)**

2 a. Sketch the structure of n-channel enhancement type MOSFET and explain its working principle. Also draw its transfer characteristics. **(07 Marks)**

b. Sketch and explain the switching characteristics of power BJT. The sketch should have the waveform i) V_{BE} ii) I_B and iii) I_C. **(06 Marks)**

c. The IGBT shown in the circuit of Fig.Q.2(c) has the following data:
$t_{on} = 3\mu sec$, $t_{off} = 1.2\mu sec$. Duty cycle D = 0.7, $V_{ce(sat)} = 2V$, $f_s = 1kHz$. Determine:
i) Average load current.
ii) Conduction power loss.
iii) Switching power loss during turn-on and turn off. **(07 Marks)**

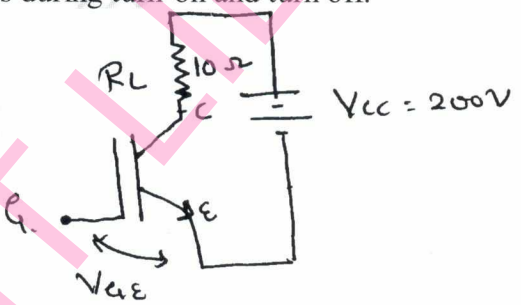

Fig.Q.2(c)

3 a. Using two transistor analogy, derive an expression for anode current of SCR. **(06 Marks)**

b. The SCR in Fig.Q.3(b) is used to control power in resistance R. The supply is 400V, and the maximum allowable di/dt and dv/dt the SCR are 50 A/μsec and 200 V/μsec respectively. Compute the values of the di/dt inductor and the snubber circuit components R_s and C_s. **(06 Marks)**

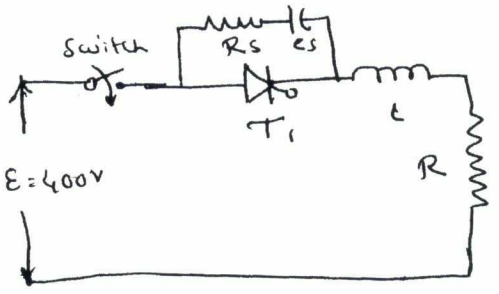

Fig.Q.3(b)

c. Mention and explain the various methods of turn-on used in thyristors. **(08 Marks)**

4 a. State the conditions to be satisfied for proper turn-off of SCR. **(02 Marks)**

b. With the help of circuit diagram and waveforms explain the operation of self commutation. **(08 Marks)**

c. In the Fig.Q.4(c) the source voltage $V_s = 100V$ and the current through R_1 and R_2 is 25A. The turn-off time of both the SCRS is 40 μsec. Find the value of capacitor for successful commutation and hence show that circuit turn off time is 0.693 RC. **(10 Marks)**

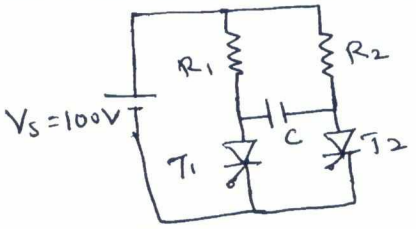

Fig.Q.4(c)

PART – B

5 a. With neat circuit and waveform derive an expression for the RMS value of output voltage of single phase semi converter with R.L. load (Assume discontinuous load current). **(06 Marks)**

b. A single phase half wave controlled rectifier is used to supply power to 10Ω load from 230V, 50Hz supply at a firing angle of 30°. Calculate: i) Average output voltage; ii) Effective output voltage; iii) Average load current. **(06 Marks)**

c. With neat circuit and waveforms explain the working principle of 3-ϕ half wave controlled rectifier with R load. **(08 Marks)**

6 a. What is a chopper? How are choppers classified? Give the quadrant of operation and one application of each type. **(08 Marks)**

b. With the help of a circuit schematic describe principle of step-up chopper. Obtain the expression for average output voltage in terms of duty ratio. **(06 Marks)**

c. A DC chopper has a resistive load of 20Ω and input voltage. $V_s = 220V$. When the chopper is on, its voltage drop is 1.5V and chopping frequency is 10kHz, if duty cycle is 80%. Determine the average output voltage, rms output voltage α chopper on time. **(06 Marks)**

7 a. With the help of neat diagram and waveform explain the operation of 180° mode of 3-ϕ inverter with star connected R-load. **(10 Marks)**

b. Explain the principle of operation of a single phase full bridge inverter with suitable circuit diagram and waveform. **(10 Marks)**

8 a. Distinguish between on-off control and phase control of AC voltage controller. **(04 Marks)**

b. Explain the operation of single phase bidirectional AC voltage controller for resistive load with the help of circuit diagram and waveforms. **(06 Marks)**

c. An AC voltage controller has a resistive load of R = 10Ω and rms input voltage is V_s = 120V, 60Hz. The thyristor switch is on for n = 25 cycles and off for m = 75 cycles. Determine:

i) The rms output voltage.

ii) Input power factor.

iii) Average and rms current of thyristors. **(10 Marks)**

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10EE46

Fourth Semester B.E. Degree Examination, June/July 2015
Transformers and Induction Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Describe the operation of a single-phase transformer, explaining clearly the functions of the different parts. **(06 Marks)**

b. Explain the operation of transformer under load condition and hence develop the phasor diagram of a single phase transformer under load condition. **(08 Marks)**

c. A 125 kVA transformer having primary voltage of 2000V at 50Hz has 182 primary and 40 secondary turns. Neglecting losses, calculate: i) full load primary and secondary current; ii) no load secondary induced e.m.f. and iii) the maximum flux in the core. **(06 Marks)**

2 a. Develop the exact equivalent circuit of a 1-phase transformer. From this derive the approximate and simplified equivalent circuits of the transformer. State the various assumptions made. **(08 Marks)**

b. Derive the condition for maximum efficiency. **(04 Marks)**

c. A 2300/230 V, 500 kVA, 50 Hz distribution transformer has core loss of 1600 W at rated voltage and copper loss 7.5 kW at full load. During the day it is loaded as follows:

% load	0%	20%	50%	80%	100%	125%
p.f.	-	0.7 lag	0.8 lag	0.9 lag	1	0.85 lag
Hours	2	4	4	5	7	2

Determine the all day efficiency of the transformer. **(08 Marks)**

3 a. Derive an expression for the saving of copper of autotransformer as compared to an equivalent two-winding transformer. **(06 Marks)**

b. With neat sketch, explain working of constant voltage transformer. **(06 Marks)**

c. Two single phase transformers share a load of 400 kVA at power factor of 0.8 lag. Their equivalent impedances referred to secondary winding are $(1 + j2.5)\ \Omega$ and $(1.5 + j3)\ \Omega$ respectively. Calculate the load shared by each transformer. **(08 Marks)**

4 a. Draw the Scott connection of transformers and mark the terminals and turn ratio. What are the applications of Scott connection? **(08 Marks)**

b. Discuss the essential and desirable conditions to be fulfilled for operating two three phase transformers in parallel. **(04 Marks)**

c. A 400 kVA load at 0.7 pf lagging is supplied by three single phase transformers connected in Δ - Δ. Each of Δ - Δ transformers is rated at 200 kVA, 2300/230 V. If one defective transformer is removed from service, calculate for V – V connection:

i) The kVA load carried by each transformer.
ii) Percent rated load carried by each transformer.
iii) Total kVA ratings of the transformer bank in V – V.
iv) Ratio of V – V bank to Δ - Δ bank transformer ratings. **(08 Marks)**

PART – B

5 a. Draw and explain the complete torque-speed characteristic of three phase induction machine for all ranges of speed. **(06 Marks)**

b. Explain the concept of rotating magnetic field in 3-phase induction motor. **(06 Marks)**

c. A 746 kW, 3-phase, 50Hz, 16-pole induction motor has a rotor impedance of (0.02 + j0.15) Ω at stand still. Full load torque is obtained at 360 rpm. Calculate: i) The speed at which maximum torque occurs; ii) The ratio of maximum to full-load torque; iii) The external resistance per phase to be inserted in the rotor circuit to get maximum torque at starting. **(08 Marks)**

6 a. Explain cogging and crawling phenomenon in 3-ϕ induction motor. **(06 Marks)**

b. A 50 kW, 6-pole, 50 Hz, 450 V, 3-ϕ induction motor furnished the following test figures: No load test: 450 V, 20A, p.f. = 0.15. Blocked rotor test: 200V, 150A, pf = 0.3. The ratio of stator to rotor copper losses on short circuit was 5:4. Draw circle diagram and determine from it.

i) Full load current and p.f.
ii) Maximum torque and maximum power input.
iii) Slip at full load.
iv) Efficiency at full load. **(14 Marks)**

7 a. Describe with sketch, the construction of a double cage induction motor. **(07 Marks)**

b. Explain with sketch deep-bar cage motor. **(06 Marks)**

c. Explain theory of self excited induction generator. **(07 Marks)**

8 a. With neat sketch, explain auto transformer starter. **(06 Marks)**

b. With neat diagram, explain shaded pole single phase motor. **(06 Marks)**

c. Briefly explain different speed control methods of 3-ϕ induction motor. **(08 Marks)**

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MATDIP401

Fourth Semester B.E. Degree Examination, June/July 2015
Advanced Mathematics - II

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Find the angle between 2 diagonals of a cube. **(06 Marks)**

b. If A(0 9 6), B(1 2 3) , C(7 - 25) are vertices of a triangle. Find the coordinates of the foot of the perpendicular drawn from A to BC. **(07 Marks)**

c. Find the equation of the plane in the Intercept form $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$. **(07 Marks)**

2 a. Find the equation of the plane passing through the three points (2, 3, 4) , (-3, 5, 1) (4, -1, 2). **(06 Marks)**

b. Find the equation of the plane through the points (1, 2, -1) and perpendicular to the planes $x + y - 2z = 5$ and $3x - y + 4z = 12$. **(07 Marks)**

c. Find the equation of the plane through the points (-1, 2, 0) and containing the plane $2x + 3y + 5z - 1 = 0$ and $3x + y - z + 2 = 0$. **(07 Marks)**

3 a. Find the unit vector parallel to the sum of the vector $\vec{A} = 2i + 4j - 5k$ and $\vec{B} = i + 2j + 3k$. **(06 Marks)**

b. Determine λ such that $\vec{A} = i + j + k$, $\vec{B} = 2i - 4k$. $\vec{C} = i + \lambda j + 3k$ are coplanar. **(07 Marks)**

c. Prove that $(\vec{a}\times\vec{b})\times\vec{c} = (\vec{a}.\vec{c})\vec{b} - (\vec{b}.\vec{c})\vec{a}$. **(07 Marks)**

4 a. Prove that $\frac{d}{dt}[\vec{F}.\vec{G}] = \vec{F}.\frac{d\vec{G}}{dt}+\frac{d\vec{F}}{dt}.\vec{G}$. **(06 Marks)**

b. Find the velocity and acceleration for the curve $\vec{r} = (1-t^3)\,i + (1+t^2)j + (2t - 5)k$ at $t = 1$ and also find their magnitude. **(07 Marks)**

c. If $\frac{d\vec{a}}{dt} = \vec{w}\times\vec{a}$ and $\frac{d\vec{b}}{dt} = \vec{w}\times\vec{b}$ then show that $\frac{d}{dt}[\vec{a}\times\vec{b}] = \vec{w}\times(\vec{a}\times\vec{b})$. **(07 Marks)**

5 a. Find the directional derivative of $\phi = x^2yz + 4xz^2$ at (1, -2, -1) along $2i - j - 2k$. **(06 Marks)**

b. If $\vec{F} = (x + y + 1)\,i + j - (x + y)k$. Find $\vec{F}.\text{curl}\,\vec{F}$. **(07 Marks)**

c. Show that $\nabla.(\nabla\times\vec{A}) = 0$. **(07 Marks)**

6 a. Find L f(t) given that $f(t) = \begin{cases} t\,; & 0 < t < 4 \\ 5\,; & t > 4 \end{cases}$ **(05 Marks)**

b. Find i) $L[e^{3t}\sin 5t\,\sin 3t]$ ii) $L[t^5\cosh 3t]$ iii) $L[t^3 e^{-3t}]$. **(15 Marks)**

7 a. Find $L\left[\frac{1-e^t}{t}\right]$. **(05 Marks)**

b. Find i) $L^{-1}\left[\frac{4s+5}{(s-1)^2(s+2)}\right]$ ii) $L^{-1}\left[\frac{4s+15}{16s^2-25}\right]$ iii) $L^{-1}\left[\frac{s}{s^2-6s+9}\right]$. **(15 Marks)**

8 a. Using Laplace transform solve :

$$\frac{dzy}{dt^2} + 4\frac{dy}{dt} + 3y = e^t \quad ; \quad y(0) = 0 \quad y'(0) = 1.$$ **(10 Marks)**

b. Solve using Laplace transformation method

$y'' + 2y' - 3y = \sin t, \quad y(0) = y'(0) = 0.$ **(10 Marks)**

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