IV EC, EE (S)

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10MAT41

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
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. Using Taylor series method, solve $\frac{dy}{dx} = 2y + 3e^x$, $y(0) = 0$ at $x = 0.2$. **(06 Marks)**

b. Using Runge – Kutta method of fourth order solve for $y(0.1)$, $y(0.2)$ given that $\frac{dy}{dx} = y(x + y)$, $y(0) = 1$. **(07 Marks)**

c. Given $\frac{dy}{dx} = x^2 (1 + y)$ and $y(1) = 1$, $y(1.1) = 1.233$, $y(1.2) = 1.548$, $y(1.3) = 1.979$, evaluate $y(1.4)$ by Milne's Predictor – Corrector method. **(07 Marks)**

2 a. Approximate y and z at $x = 0.1$, using Picard's method for the solution of the equations $\frac{dy}{dx} = z$, $\frac{dz}{dx} = x^3 (y + z)$, given that $y(0) = 1$ and $z(0) = ½$. **(06 Marks)**

b. Using Runge – Kutta fourth order method to solve $y'' = xy' - y$, $y(0) = 3$, $y'(0) = 0$, find y and z at $x = 0.1$. **(07 Marks)**

c. Apply Milne's method to compute $y(0.4)$ given that $y'' + xy' + y = 0$ and the values $y(0) = 1$, $y(0.1) = 0.995$, $y(0.2) = 0.9801$, $y(0.3) = 0.956$, $y'(0) = 0$, $y'(0.1) = -0.0995$, $y'(0.2) = -0.196$, $y'(0.3) = -0.2867$. **(07 Marks)**

3 a. Prove that the C – R equations in polar form. **(06 Marks)**

b. Show that $f(z) = z^n$, where n is a positive integer is analytic and hence find its derivative. **(07 Marks)**

c. If $\phi + i\Psi$ represents the complex potential of an electrostatic field where $\Psi = x^2 - y^2 + \frac{x}{x^2 + y^2}$, find ϕ. **(07 Marks)**

4 a. Find the Bilinear transformation which maps the points 1, i – 1 into 0, 1, ∞. **(06 Marks)**

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

c. Evaluate $\int_c \frac{e^{2z}}{(z+1)(z-2)} dz$, where c : | z | = 3. **(07 Marks)**

PART – B

5 a. Find the solution of the Laplace's equation in cylindrical system leading to Bessel's differential equation. **(06 Marks)**

b. Derive Rodrigue's formula $P_n(x) = \frac{1}{2^n n!} \frac{d^n}{dx^n} (x^2 - 1)^n$. **(07 Marks)**

c. Express $f(x) = x^4 + 3x^3 - x^2 + 5x - 2$ in terms Legendre polynomials. **(07 Marks)**

6 a. Define the Empherical and Axiomatic definition of probability and give an example of each. **(06 Marks)**

b. Of the cigarette smoking population 70% are men and 30% are women, 10% of these men and 20% of these women smoke wills. What is the probability that person seen smoking a wills will be a man? **(07 Marks)**

c. The chance that a doctor will diagnose a disease correctly is 60%. The chance that a patient will die after correct diagnose is 40% and the chance of death by wrong diagnosis is 70%. If a patient dies, what is the chance that his disease was correctly diagnosed? **(07 Marks)**

7 a. Derive the mean and variance of Binomial distribution. **(06 Marks)**

b. If x is an exponential distribution with mean 4, evaluate i) $P(0 < x < 1)$ ii) $P(x > 2)$ and iii) $P(-\infty < x < 10)$. **(07 Marks)**

c. The marks of 1000 students in an examination follows a normal distribution with mean 70 and standard deviation 5. Find the number of students whose marks will be i) less than 65 ii) More than 75 and iii) between 65 and 75. **(07 Marks)**

8 a. Define the following terms :
i) Type I – error and Type II – error ii) Level of significance. **(06 Marks)**

b. A certain stimulus administered to each of the 12 patients resulted in the following :
Change in blood pressure 5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4, can it be concluded that the stimulus will increase the blood pressure? (t. 05 for 11 d.f = 2.201). **(07 Marks)**

c. The theory predicts the proportion of beans in the four groups G_1, G_2, G_3, G_4 should be in the ratio 9:3:3:1. In an experiment with 1600 beans the numbers in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory? (at 5% LOS for 3 d.f = 7.815). **(07 Marks)**

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10ES42

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Microcontrollers

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Distinguish Harvard and Von-Neumann (Princeton) architectures with diagrams. **(06 Marks)**

b. Explain with block diagram the architectural feature of 8051 and list out salient features of 8051 microcontroller. **(08 Marks)**

c. Discuss the need for stack memory in microcontrollers. Explain with examples the PUSH and POP instructions. **(06 Marks)**

2 a. What are the addressing modes supported by 8051 μC? Explain with examples. **(08 Marks)**

b. Explain the different types of conditional and unconditional jump instructions of 8051. Specify the different ranges associated with jump instructions. **(08 Marks)**

c. Differentiate between the following instructions:
i) SWAP and XCH ii) SJMP and LJMP. **(04 Marks)**

3 a. Write a ALP to copy the most significant nibble of A in both nibbles of RAM address 3Ch. Also write the algorithm for example if A = 36h, then 3Ch = 33h. **(06 Marks)**

b. Write an ALP to add the unsigned numbers found in internal RAM locations 25h, 26h and 27h together and put the result in RAM locations 31L (MSB) and 30h (LSB). **(08 Marks)**

c. For a machine cycle of 1.085 μsec find the time delay in the following subroutine:

```
DELAY: MOV R2, # 200
AGAIN: MOV R3, # 250
HERE: NOP
      NOP
      DJNZ R3, HERE
      DJNZ R2, AGAIN
      RET.
```

(06 Marks)

4 a. With a relevant figure write a sequence of events that occur in 8051 microcontroller when the CALL and RET instructions are executed. **(06 Marks)**

b. What are the ways to create time delay? Discuss the factors affecting the accuracy of the time delay. **(07 Marks)**

c. What are the differences between timer and counter? Explain with the formats of the SFR. **(07 Marks)**

PART – B

5 a. In what way timer/counter mode 2 programming is different from mode 0 and mode 1? **(06 Marks)**

b. Write an ALP to generate square wave on pin 3.4 of ON Time 4 msec and OFF Time 3 msec, using timer 0, mode 0. Assume that crystal frequency of 8051 is 11.0592 Hz. **(08 Marks)**

c. Explain the importance of interrupt priority (IP) SFR and the beginning fixed address of the interrupt handler subroutines. **(06 Marks)**

6 a. Write the steps required for programming 8051 to transfer data serially and what is the role of PCON register in serial communication? **(07 Marks)**

b. Write a C program to interface 8051 to LCD. Draw the hardware schematic. **(07 Marks)**

c. Write a 'ALP' program to interface stepper motor to 8051, with a neat diagram of 8051 connection to stepper motor. **(06 Marks)**

7 a. Tabulate the different data types in 'C', bits and the data range. **(05 Marks)**

b. Write an 8051 C program to send two different strings to the serial port. Assuming that SW is connected to pin P2.0, monitor its status and make a decision as follows:
SW = 0, send your first name
SW = 1, send your last name.
Assume XTAL = 11.0592 MHz, baud rate of 9600, 8 bit data 1 stop bit. **(10 Marks)**

c. Write a 'C' program to serially transmit the message "HELLO" continuously at baud rate of 9600, 8-bit data and 1 stop bit. **(05 Marks)**

8 a. Briefly discuss the features of MSP 430 microcontrollers. **(06 Marks)**

b. Explain different addressing modes of MSP 430 with examples. **(08 Marks)**

c. Write a MSP 430 assembly program to find the largest in the given array of 'n' bytes. **(06 Marks)**

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10ES43

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Control Systems

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. A mechanical system is shown in the Fig.Q.1(a).
   i) Obtain the performance equations.
   ii) Draw the electrical analog based on force-current analogy. **(08 Marks)**

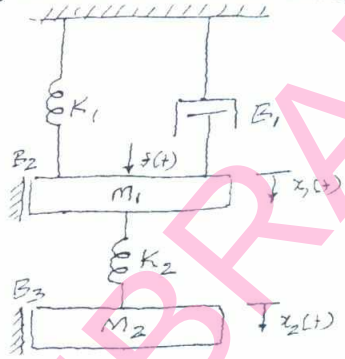

Fig.Q.1(a)

b. For the mechanical system shown in Fig.Q.1(b), draw the electrical network based on torque current analogy. Write the performance equations. **(08 Marks)**

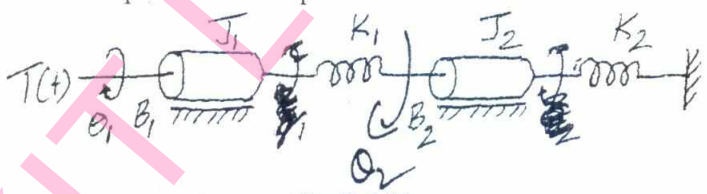

Fig.Q.1(b)

c. Write an explanatory note on gear trains. **(04 Marks)**

2 a. Define the term transfer function of a linear time invariant system. Derive the expression for the transfer function of a closed loop negative feedback system. **(06 Marks)**

b. For the block diagram shown in the Fig.Q.2(b), determine the overall transfer function using block diagram reduction rules. **(06 Marks)**

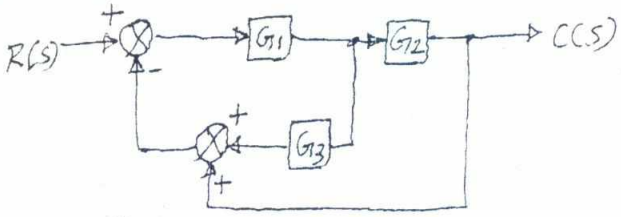

Fig.Q.2(b)

c. Consider the electrical circuit shown in Fig.Q.2(c). Find $\frac{V_0(s)}{V_i(s)}$ using Mason's gain formula. **(08 Marks)**

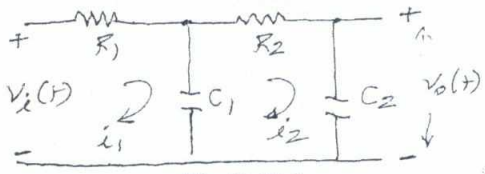

Fig.Q.2(c)

3 a. Define the following terms with respect to an underdamped second order system:
i) Peak time; ii) Settling time; iii) Steady state error. **(06 Marks)**

b. A unity feedback system is characterized by an open loop transfer function $G(s) = \frac{K}{s(s+10)}$.

Determine the gain K so that the system will have a damping ratio of 0.5. For this value of K, determine settling time, peak over shoot and time to peak overshoot for a unit step input. **(08 Marks)**

c. For a unity feedback system whose open loop transfer function is $G(s) = \frac{50}{(1+0.1s)(1+2s)}$.

Find the error constants K_p, K_v, K_a. **(06 Marks)**

4 a. State the Routh's stability criterion and mention its limitation. **(04 Marks)**

b. Consider the characteristic equation $s^6 + 2s^5 + 8s^4 + 12s^3 + 20s^2 + 16s + 16 = 0$. Using Routh's criterion, determine the stability of the system. **(08 Marks)**

c. The closed loop system shown in Fig.Q.4(c) has $G(s) = \frac{K(s+30)}{s(s+5)}$ and $H(s) = \frac{1}{(s+15)}$.

Find the range of K for which system is stable. **(08 Marks)**

Fig.Q.4(c)

PART – B

5 a. Discuss the various rules for construction of root loci. **(08 Marks)**

b. A negative feedback control system is characterized by $G(s)H(s) = \frac{K}{s(s+1)(s+2)(s+3)}$.

Sketch the root locus plot for values of K ranging from 0 to ∞, Mark all the salient points on the root locus. **(12 Marks)**

6 a. Discuss the procedure to evaluate Gain margin and phase margin using Bode plots. **(06 Marks)**

b. Sketch the Bode plot for the transfer function $G(s) = \frac{Ks^2}{(1+0.2s)(1+0.02s)}$. Determine the system gain K for the gain cross over frequency to be 5 rad/sec. **(08 Marks)**

c. For the Bode magnitude asymptotic plot of Fig.Q.6(c), determine the transfer function in frequency domain. **(06 Marks)**

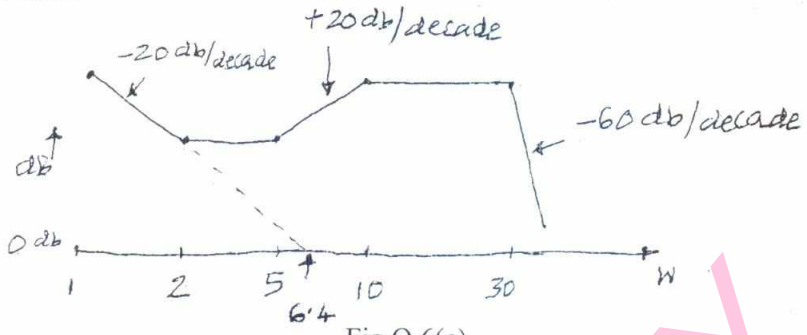

Fig.Q.6(c)

7 a. State the Nyquist stability criterion. **(06 Marks)**

b. Using the Nyquist stability criterion, investigate the stability of a closed loop system whose open loop transfer function is given by $G(s)H(s) = \frac{K}{(s+1)(s+2)}$. **(14 Marks)**

8 a. State the properties of state transition matrix. **(04 Marks)**

b. Represent the electrical circuit shown in Fig.Q.8(b) by a state model. **(08 Marks)**

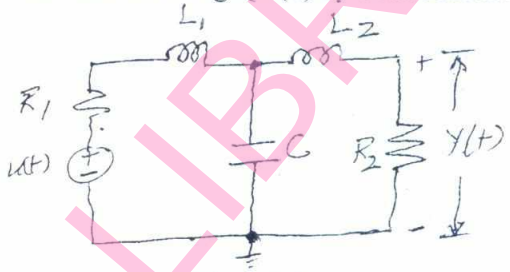

Fig.Q.8(b)

c. For the signal flow graph of Fig.Q.8(c) write the state and output equations: **(08 Marks)**

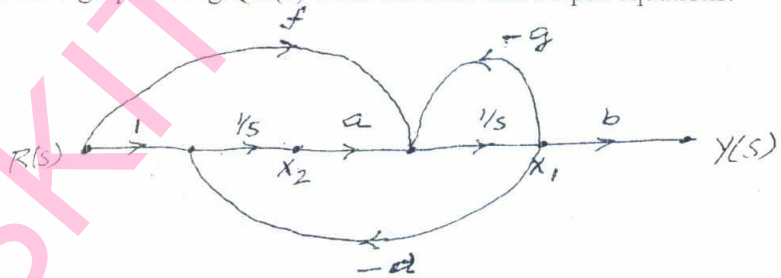

Fig.Q.8(c)

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10EE44

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
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. State and explain Coulomb's law in vector form. **(05 Marks)**

b. Two point charges $Q_1 = -0.3nC$ at [25, –30, –15], and $Q_2 = 0.5nC$ at [–10, 8, 12] present in free space determine $\vec{E}$ at P(15, 20, 50). **(05 Marks)**

c. Given $D = 4y^2\hat{a}_x + 3x^2y\hat{a}_y + 15\hat{a}_z\ C/m^2$ verify both sides of Divergence theorem and evaluate charge enclosed within region $0 < x, y, z < 2$. **(10 Marks)**

2 a. Find out the work done in moving a charge $\rho = a$ to $\rho = b$ along with radial direction due to infinite line charge. **(06 Marks)**

b. Given a potential $V = 3x^2 + 4y^2(V)$, find the energy stored in volume described by $0 \le x \le 1m$, $0 \le y \le 1m$ and $0 \le z \le 1m$. **(06 Marks)**

c. Obtain the boundary condition between conductor and free space. **(08 Marks)**

3 a. State and prove uniqueness theorem. **(08 Marks)**

b. In spherical co-ordinates V = 0 at r = 0.1 m and V = 100 V at r = 2m. Assuming free space between the concentric spherical shell find $\vec{E}$ and $\vec{D}$. **(06 Marks)**

c. Use Laplace equation to find the capacitance between two plate of a parallel plate capacitor, separated by distance 'd" and maintained at potential "o" and "V_0" respectively. **(06 Marks)**

4 a. Find the magnetic field intensity and flux density at the centre, of a circular wire carrying a current 'I' and of radius 'a' by using Biot – Savart's law. **(06 Marks)**

b. In cylindrical co-ordinates a magnetic field is given as $\vec{H} = [4\rho - 2\rho^2]\hat{a}_\phi\ A/m\ 0 \le \rho \le 1$

i) Find the current density as a function of ρ within the cylinder

ii) Find the total current that passes through the surface $z = 0$ and $0 \le \rho \le 1m$ in $\hat{a}_z$ direction. **(06 Marks)**

c. Define vector magnetic potential and prove that $A = \frac{\mu_0}{4\pi}\int_v \frac{J}{r}\cdot dv$. **(08 Marks)**

PART – B

5 a. Derive an expression for the force between two differential current elements. **(06 Marks)**

b. The z = 0 marks the boundary between two magnetic materials. For region 1, $(z > 0)$, $\mu_1 = 4$ μH and region 2, $(z < 0)$, $\mu_2 = 6$ μH. The surface current density at the boundary is given as $\vec{K} = 12\hat{a}_y\ A/m$, find $\vec{H}_2$ if $\vec{H}_1 = 40\hat{a}_x + 50\hat{a}_y + 12\hat{a}_z\ kA/m$. **(06 Marks)**

c. Calculate the inductance of a solenoid of 200 turns wound tightly on a cylindrical type of length 60 cm and of diameter 6 cm. Given that the medium is air. Derive the expression used. **(08 Marks)**

6 a. List Maxwell's equations for time varying field in point and integral form. **(06 Marks)**

b. Starting from Ampere's circuital law derive an expression for displacement current density for time varying fields. **(06 Marks)**

c. What is retarded potential? Obtain an expression for retarded potential V and A. **(08 Marks)**

7 a. State and prove Poynting's theorem. **(10 Marks)**

b. With respect to wave propagation in good conductors, describe what is skin effect, derive an expression for the depth of penetration. If $\sigma = 58 \times 10^6$ ℧/m at frequency 10 MHz determine depth of penetration. **(10 Marks)**

8 a. The plane $x = 0$ is the boundary between two perfect dielectric. For $x < 0$, $\mu_1 = \mu_0$, $\varepsilon_1 = 3.6\pi$ pf/m and $\sigma_1 = 0$; for $x > 0$, $\mu_2 = \mu_0$, $\varepsilon_2 = 14.4\pi$ pf/m and $\sigma_2 = 0$.

If $E_i^+ = 60\cos(10^9 t - \beta_1 x)V/m$ find :

i) Incident magnetic field H_i

ii) Reflected electric and magnetic field E_r and H_r

iii) Transmitted electric and magnetic field E_t and H_t **(10 Marks)**

b. What is a standing wave? Derive an expression for standing wave ratio. **(10 Marks)**

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10EE45

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Power Electronics

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain the various types of power electronic converter circuits. Draw the input and output characteristics. **(10 Marks)**

b. Draw and explain the V-I characteristic of the following power electronic devices:
i) SCR; ii) IGBT; iii) GTO; iv) TRIAC; v) BJT. **(10 Marks)**

2 a. What is the need of a base drive control in a power transistor? Explain anti-saturation control. **(08 Marks)**

b. In the bipolar transistor shown in Fig.Q.2(b) β varies between 5 and 50. The load resistance $R_C = 10\Omega$, $V_{CC} = 180V$, $V_{BB} = 10V$. If $V_{CE(sat)} = 1.0V$ and $V_{BE(sat)} = 1.4V$. Find:
i) The value of R_B that results in saturation with an overdrive factor of 6.
ii) Forced β_F.
iii) Power loss P_T in the transistor. **(06 Marks)**

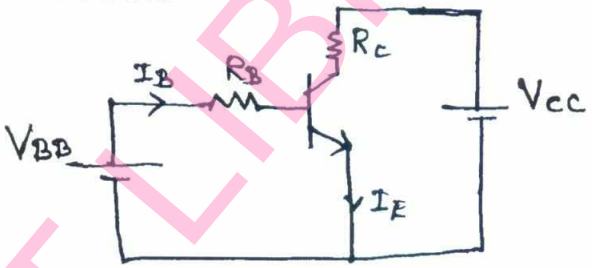

Fig.Q.2(b)

c. Draw and explain the switching characteristics of power MOSFET. **(06 Marks)**

3 a. Derive an expression for the anode current of thyristor with the help of two transistor analogy. **(08 Marks)**

b. A string of thyristor is connected to withstand a d.c. voltage of $V_S = 15kV$. The maximum leakage current and recovery charge difference of thyristor are 10mA and 150μC respectively. A derating factor of 20% is applied for the steady state and transient voltage sharing of thyristor. If the maximum steady state voltage sharing is 1000V. Find:
i) The steady state voltage sharing resistance R for each thyristor and
ii) The transient voltage capacitance C for each thyristor. **(08 Marks)**

c. Differentiate latching current and holding current of a thyristor. **(04 Marks)**

4 a. What is meant by commutation? Differentiate natural and forced commutation. **(06 Marks)**

b. With neat circuit diagram and waveforms explain complimentary commutation. **(10 Marks)**

c. For the commutation circuit shown in Fig.Q.4(c). Calculate the value of the capacitance C to provide the circuit turn-off time of 20μsec. DC source voltage is 100V and current through R_1 and R_2 is 10A. **(04 Marks)**

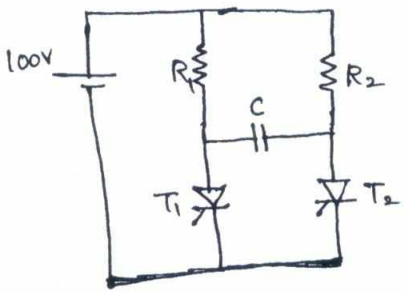

Fig.Q.4(c)

PART – B

5 a. Explain with neat diagram and waveforms, the operation of single phase semi-controlled rectifier feeding resistive load. **(10 Marks)**

b. In a single phase half wave controlled circuit shown in Fig.Q.5(b) with pure resistive load $R = 1\Omega$ and $\alpha = \pi/2$. Determine:

i) Rectification efficiency
ii) Form factor
iii) Ripple factor
iv) Transform utilization factor
v) Peak inverse voltage. **(10 Marks)**

Given $V_s = V_m \sin \omega t$

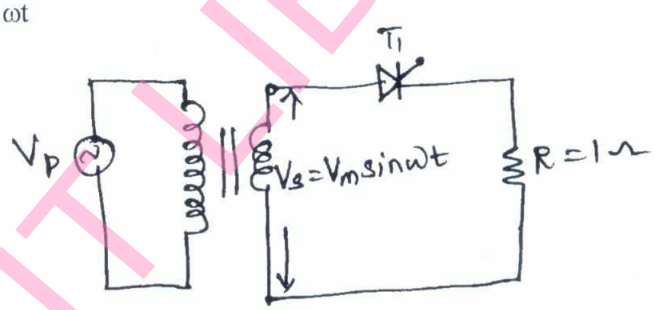

Fig.Q.5(b)

6 a. Explain the various classifications of chopper circuits. **(10 Marks)**

b. With a neat circuit diagram and waveforms, explain the analysis of impulse commutated thyristor chopper. **(10 Marks)**

7 a. Explain the operation of a single phase full bridge inverter supplying a resistive load. **(10 Marks)**

b. Explain: i) Sinusoidal pulse width modulation; ii) Performance parameters of an inverter. **(10 Marks)**

8 a. With the help of neat circuit diagram and waveforms, explain the operation of a bidirectional controller with resistive load. Derive the equation for V_{rms}. **(10 Marks)**

b. Describe the effect of power electronic converters. What are the remedial measures? **(10 Marks)**

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10EE46

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Transformers & Induction Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Derive the emf equation of a single phase transformer. **(04 Marks)**

b. Explain the operation of a single phase transformer on inductive load with a phasor diagram. **(08 Marks)**

c. The maximum efficiency of a 100 kW transformer is 98% and occurs at $\frac{3}{4}$ full load. The transformer is on full load for 4 hrs, on $\frac{3}{4}$ load for 6 hrs half load for 6 hrs and $\frac{1}{10}$ load for remaining part of the day. Determine its all-day efficiency. **(08 Marks)**

2 a. Explain OC and SC test for predetermination of efficiency and regulation. **(06 Marks)**

b. Define voltage regulation and derive an expression for voltage regulation. What is the condition for zero regulation? **(06 Marks)**

c. The efficiency at 0.8 pf lag of a 6600/384 V, 200 KVA, 1 ϕ transformer is 98% both at full load and $\frac{1}{2}$ full load. The pf. on no load is 0.2 and full load regulation at a lagging pf of 0.8 is 4.5%. Draw the equivalent circuit referred to LV side and insert all values. **(08 Marks)**

3 a. Show that an auto transformer will result in saving of copper instead of 2-winding transformer. **(06 Marks)**

b. List out and explain the conditions for parallel operation of single phase transformers. **(06 Marks)**

c. Two transformers having equivalent impedances referred to secondary of $(0.3+j3)\Omega$ and $(0.2+j1)\Omega$ are sharing a common load of impedance $(8+j6)\Omega$. Determine the current delivered by each transformer if the open circuit emf are 6600 V and 6400 V. **(08 Marks)**

4 a. Explain the operation of scott connections for balanced and unbalanced load with the help of phasor diagrams. **(12 Marks)**

b. A Δ - Δ bank consisting of three 1ϕ transformers, 20 KVA, 2300/230 V ratings supplies a load of 40 KVA. If one transformer is removed, find for the resulting V – V connection,
i) KVA load carried by each transformer.
ii) Total KVA rating of the V-V bank.
iii) Ratio of the V-V bank to Δ-Δ bank transformer ratings. **(08 Marks)**

PART – B

5 a. Explain the constructional details of different types of 3ϕ Induction motors. **(08 Marks)**

b. Explain the different regions of torque-slip characteristics of a 3ϕ induction motor and mark all the points on the characteristics. **(08 Marks)**

c. An 8-pole 50 Hz induction motor has a full load slip of $2\frac{1}{2}$% and a maximum torque of twice full-load torque. At what value of slip does maximum torque occur? **(04 Marks)**

6 a. Develop the phasor diagram and equivalent circuit of a 3φ induction motor. **(06 Marks)**

b. Draw the circle diagram for a 5 h.p. 200 V, 50 Hz, 4 pole, 3φ star connected induction motor from the following test data:
No load : 200 V, 5 A, 350 W
SC test : 100 V, 26 A, 1700 W
Estimate the line current and power factor for full load and also maximum torque and starting torque interms of full load torque. The rotor copper loss at stand still is half the total copper loss. **(14 Marks)**

7 a. Explain the construction and operation of a double cage induction motor. **(08 Marks)**

b. Explain the phasor diagram and torque – slip characteristics of an induction generator. **(08 Marks)**

c. Why a starter is required for starting a 3φ IM? **(04 Marks)**

8 a. Explain briefly the operation of a Y-Δ starter with a neat diagram. **(08 Marks)**

b. Give a comparison between speed control of a 3φ induction motor by stator voltage control and rotor resistance control. **(04 Marks)**

c. Explain the constructional and operational features of a capacitor start and run single phase induction motor. **(08 Marks)**

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MATDIP401

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Advanced Mathematics – II

Time: 3 hrs. Max. Marks:100

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

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

b. The direction cosines of three mutually perpendicular lines are l_1, m_1, n_1 l_2, m_2, n_2 and l_3, m_3, n_3. Show that the line with direction cosines $l_1+l_2+l_3$, $m_1+m_2+m_3$, $n_1+n_2+n_3$ is equally inclined to the above lines. **(07 Marks)**

c. Find the equations of the plane passing through the points (1, 2, 3) (0, 1, 4) and (0, 0, 1). **(07 Marks)**

2 a. Derive the equation to the plane in the intercept form $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$. **(06 Marks)**

b. Find the angle between the lines $\frac{x-1}{1}=\frac{y-5}{0}=\frac{z+1}{2}$ and $\frac{x+3}{3}=\frac{y}{5}=\frac{z-5}{2}$. **(07 Marks)**

c. Find the image of the point (1, 2, 3) in the line $\frac{x+1}{2}=\frac{y-3}{3}=-z$. **(07 Marks)**

3 a. Show that the position vectors of the vertices of a triangle $2i-j+k$, $i-3j-5k$, $3i-4j-4k$ form a right angled triangle. **(06 Marks)**

b. Find a vector of magnitude 12 units which is perpendicular to the vectors $\vec{a}=4i-j+3k$ and $\vec{b}=-2i+j-2k$. **(07 Marks)**

c. Find λ so that the points $A(-1,4,-3)$, $B(3,2,-5)$, $C(-3,8,-5)$ and $D(-3,\lambda,1)$ are coplanar. **(07 Marks)**

4 a. Find the unit tangent vector of the space curve $x=1+t^3$, $y=2t^3$, $z=2-t^3$ at $t=1$. **(06 Marks)**

b. Find the angle between the tangents to the curve $\vec{r}=\left(t-\frac{t^2}{2}\right)i+t^2j+\left(t+\frac{t^2}{2}\right)k$ at $t=\pm1$. **(07 Marks)**

c. A particle moves along the curve whose parametric equations are $x=t-\frac{t^3}{3}$, $y=t^2$ and $z=t+\frac{t^3}{3}$, where 't' is the time. Find the velocity and acceleration at any time 't'. Also find their magnitudes at t = 3. **(07 Marks)**

5 a. Find the angle between the surfaces $x^2+y^2+z^2=9$ and $x=z^2+y^2-3$ at (2,–1,2). **(06 Marks)**

b. Find the constants a, b, c such that the vector ,
$\vec{F}=(x+y+az)i+(bx+2y-z)j+(x+cy+2z)k$ is irrotational. **(07 Marks)**

c. If $\vec{A}=\text{grad}(x^3+y^3+z^3-3xyz)$ then find div $\vec{A}$ and curl $\vec{A}$. **(07 Marks)**

6 a. Find the expression for L[sin at]. **(05 Marks)**

b. Find $L[t \sin at]$. **(05 Marks)**

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

d. Find $L[e^t \cos^2 2t]$. **(05 Marks)**

7 a. Find $L^{-1}\left[\frac{s}{(s+2)(s^2+1)}\right]$. **(06 Marks)**

b. Find $L^{-1}\left[\frac{s+2}{s^2+2s+2}\right]$. **(07 Marks)**

c. Find $L^{-1}\left[\log\left[\frac{s^2+1}{s(s-1)}\right]\right]$. **(07 Marks)**

8 a. Using Laplace transform solve:
$y'' - 2y' + y = e^{2t}$ with $y(0) = 0$ and $y'(0) = 1$. **(10 Marks)**

b. Solve using Laplace transformation, method $y'' + 2y' - 3y = \sin t$, $y(0) = y'(0) = 0$. **(10 Marks)**

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