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10MAT41

Fourth Semester B.E. Degree Examination, December 2012

Engineering Mathematics – IV

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Using the Taylor's series method, solve the initial value problem $\frac{dy}{dx} = x^2y - 1$, y(0) = 1 at the point x = 0.1 **(06 Marks)**

b. Employ the fourth order Runge-Kutta method to solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$, y(0) = 1 at the points x = 0.2 and x = 0.4. Take h = 0.2. **(07 Marks)**

c. Given $\frac{dy}{dx} = xy + y^2$, y(0) = 1, y(0.1) = 1.1169, y(0.2) = 1.2773, y(0.3) = 1.5049. Find y(0.4) using the Milne's predictor-corrector method. Apply the corrector formula twice. **(07 Marks)**

2 a. Employing the Picard's method, obtain the second order approximate solution of the following problem at x = 0.2.

$$\frac{dy}{dx} = x + yz,\quad \frac{dz}{dx} = y + zx,\quad y(0) = 1,\quad z(0) = -1.$$ **(06 Marks)**

b. Using the Runge-Kutta method, find the solution at x = 0.1 of the differential equation $\frac{d^2y}{dx^2} - x^2\frac{dy}{dx} - 2xy = 1$ under the conditions y(0) = 1, y′(0) = 0. Take step length h = 0.1. **(07 Marks)**

c. Using the Milne's method, obtain an approximate solution at the point x = 0.4 of the problem $\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} - 6y = 0$, y(0) = 1, y′(0) = 0.1. Given that y(0.1) = 1.03995, y(0.2) = 1.138036, y(0.3) = 1.29865, y′(0.1) = 0.6955, y′(0.2) = 1.258, y′(0.3) = 1.873. **(07 Marks)**

3 a. If f(z) = u + iv is an analytic function, then prove that $\left(\frac{\partial}{\partial x}|f(z)|\right)^2 + \left(\frac{\partial}{\partial y}|f(z)|\right)^2 = |f'(z)|^2$. **(06 Marks)**

b. Find an analytic function whose imaginary part is $v = e^x\{(x^2 - y^2)\cos y - 2xy\sin y\}$. **(07 Marks)**

c. If f(z) = u(r, θ) + iv(r, θ) is an analytic function, show that u and v satisfy the equation $\frac{\partial^2\varphi}{\partial r^2} + \frac{1}{r}\frac{\partial\varphi}{\partial r} + \frac{1}{r^2}\frac{\partial^2\varphi}{\partial\theta^2} = 0$. **(07 Marks)**

4 a. Find the bilinear transformation that maps the points 1, i, –1 onto the points i, 0, –i respectively. **(06 Marks)**

b. Discuss the transformation $W = e^z$. **(07 Marks)**

c. Evaluate $\int_C \frac{\sin\pi z^2 + \cos\pi z^2}{(z-1)^2(z-2)}dz$, where C is the circle |z| = 3. **(07 Marks)**

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.

PART – B

5 a. Express the polynomial $2x^3 - x^2 - 3x + 2$ in terms of Legendre polynomials. **(06 Marks)**

b. Obtain the series solution of Bessel's differential equation $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 - n^2)y = 0$ in the form $y = AJ_n(x) + BJ_{-n}(x)$. **(07 Marks)**

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

6 a. State the axioms of probability. For any two events A and B, prove that $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. **(06 Marks)**

b. A bag contains 10 white balls and 3 red balls while another bag contains 3 white balls and 5 red balls. Two balls are drawn at ransom from the first bag and put in the second bag and then a ball is drawn at random from the second bag. What is the probability that it is a white ball? **(07 Marks)**

c. In a bolt factory there are four machines A, B, C, D manufacturing respectively 20%, 15%, 25% 40% of the total production. Out of these 5%, 4%, 3% and 2% respectively are defective. A bolt is drawn at random from the production and is found to be defective. Find the probability that it was manufactured by A or D. **(07 Marks)**

7 a. The probability distribution of a finite random variable X is given by the following table:

x_i	-2	-1	0	1	2	3
$p(x_i)$	0.1	k	0.2	2k	0.3	k

Determine the value of k and find the mean, variance and standard deviation. **(06 Marks)**

b. The probability that a pen manufactured by a company will be defective is 0.1. If 12 such pens are selected, find the probability that (i) exactly 2 will be defective, (ii) at least 2 will be defective, (iii) none will be defective. **(07 Marks)**

c. In a normal distribution, 31% of the items are under 45 and 8% are over 64. Find the mean and standard deviation, given that A(0.5) = 0.19 and A(1.4) = 0.42, where A(z) is the area under the standard normal curve from 0 to z >0. **(07 Marks)**

8 a. A biased coin is tossed 500 times and head turns up 120 times. Find the 95% confidence limits for the proportion of heads turning up in infinitely many tosses. (Given that $z_c = 1.96$) **(06 Marks)**

b. A certain stimulus administered to each of 12 patients resulted in the following change in blood pressure:

5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4 (in appropriate unit)

Can it be concluded that, on the whole, the stimulus will change the blood pressure. Use $t_{0.05}(11) = 2.201$. **(07 Marks)**

c. A die is thrown 60 times and the frequency distribution for the number appearing on the face x is given by the following table:

x	1	2	3	4	5	6
Frequency	15	6	4	7	11	17

Test the hypothesis that the die is unbiased.
(Given that $\chi^2_{0.05}(5) = 11.07$ and $\chi^2_{0.01}(5) = 15.09$) **(07 Marks)**

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Fourth Semester B.E. Degree Examination, December 2012

Microcontrollers

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Mention the difference between RISC and CISC processor. **(06 Marks)**

b. Explain function of following pins of 8051:

i) $\overline{EA}$

ii) ALE

iii) $\overline{PSEN}$

iv) RST **(08 Marks)**

c. Explain the internal memory organization of 8051. **(06 Marks)**

2 a. With necessary examples, explain immediate, bit direct and indexed addressing mode of 8051. **(06 Marks)**

b. Explain the effect of following instructions:

i) MOVX A, @dptr

ii) DJNZ R3, next

iii) DA A

iv) LJMP label **(08 Marks)**

c. Write a program segment to realize following:

i) Exchange contents of external data memory 8100 h with contents of internal data memory 40 h.

ii) Exchange contents of A-register and B-register using stack. **(06 Marks)**

3 a. What do you understand by assembler directives? Explain the following assembler directives:

i) ORG ii) END iii) EQU **(08 Marks)**

b. Write an ALP to convert a 2-digit BCD number to binary. **(06 Marks)**

c. Write a delay program to generate a delay of 10 ms. Assume a crystal of 11.0592 MHz. Show delay calculation clearly. **(06 Marks)**

4 a. Explain the usage of the port pins of 8051. **(06 Marks)**

b. With necessary interface diagram, write a C program to generate a triangular wave using DAC interface. **(06 Marks)**

c. With necessary interface diagram, write a program to display "VTU2012" on a LCD interface. **(08 Marks)**

PART – B

5 a. Mention the difference between counter mode and timer mode of operation. With necessary format, explain the various bits of TMOD-SFR. **(06 Marks)**

b. Write an 8051 C program to generate a square wave of 2 kHz using timer 1, mode 2. Show the calculations clearly. Assume a crystal frequency of 11.0592 MHz. **(08 Marks)**

c. Explain the interrupts of 8051 clearly mentioning the vector address and priorities. **(06 Marks)**

6 a. Explain the various modes of serial communication operation. **(06 Marks)**
b. Write a program to transmit a message "VTU" serially at a band rate of 9600. Take crystal frequency as 11.0592 MHz. **(08 Marks)**
c. Explain with a neat diagram, the functional block diagram of 8255. **(06 Marks)**

7 a. With necessary block diagram, explain the architecture of MSP 430. **(08 Marks)**
b. Explain clock system of MSP 430. **(08 Marks)**
c. Explain the use of registers P_XDIR and P_XOUT. **(04 Marks)**

8 a. Explain various low power operating modes of MSP 430. **(10 Marks)**
b. Explain the bits of TCON register. Write an 8051 C program to toggle only bit P1.5 continuously every 50 msec. Use timer 1 to generate the delay.
Assume XTAL = 11.0592 MHz. **(10 Marks)**

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Fourth Semester B.E. Degree Examination, December 2012
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. Compare linear and non-linear control system. **(04 Marks)**

b. For the two port network shown in Fig. Q1 (b), obtain the transfer functions, i) $\frac{V_2(s)}{V_1(s)}$ and ii) $\frac{V_1(s)}{I_1(s)}$ **(08 Marks)**

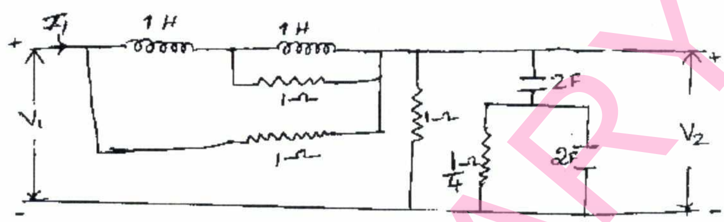

Fig. Q1 (b)

c. For the rotational system shown in Fig. Q1 (c), i) Draw the mechanical network ii) Write the differential equations iii) Obtain torque to voltage analogy. **(08 Marks)**

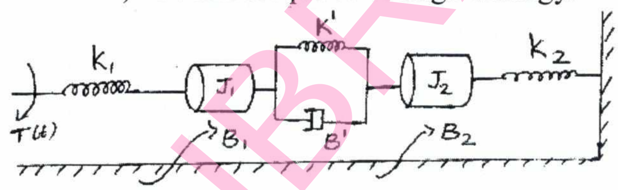

Fig. Q1 (c)

2 a. Illustrate how to perform the following, in connection with block diagram reduction rules:
i) Shifting a take-off point after a summing point.
ii) Shifting a take-off point before a summing point. **(04 Marks)**

b. The performance equations of a controlled system are given by the following set of linear algebraic equations:
i) Draw the block diagram.
ii) Find the overall transfer function $\frac{C(s)}{R(s)}$ using block diagram reduction technique.

$E_1(s) = R(s) - H_3(s)C(s)$; $E_2(s) = E_1(s) - H_1(s)E_4(s)$; $E_3(s) = G_1(s)E_2(s) - H_2(s)C(s)$
$E_4(s) = G_2(s)E_3(s)$; $C(s) = G_3(s)E_4(s)$ **(08 Marks)**

c. Draw the corresponding signal flow graph for the given block diagram is shown in Fig. Q2 (c) and obtain the overall transfer function by Mason's gain formula. **(08 Marks)**

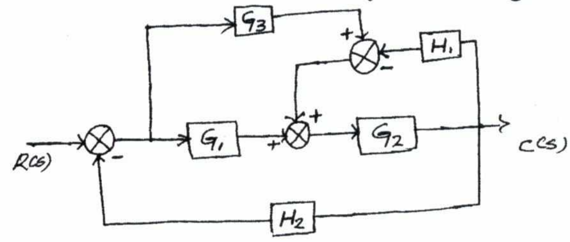

Fig. Q2 (c)

3 a. Derive the expression for peak time. **(04 Marks)**

b. The loop transfer function of a feed back control system is given by,

$$G(s)H(s) = \frac{100}{s^2(s+4)(s+12)}$$

i) Determine the static error co-efficients.

ii) Determine the steady state error for the input $r(t) = 2t^2 + 5t + 10$ **(08 Marks)**

c. A system is given by differential equation, $\frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 8y(t) = 8x(t)$.

Where y(t) = output and x(t) = input.

Determine i) peak time ii) peak over shoot iii) settling time iv) expression of the output response. **(08 Marks)**

4 a. Define the term stability applied to control system and what is the difference between absolute stability and relative stability. **(04 Marks)**

b. Using Routh's criterion determine the stability of following systems:

i) Its open loop transfer function has poles at s = 0, s = -1, s = -3 and zero at s = -5. Gain K = 10.

ii) It is a type one system with an error constant of 10 sec^{-1} and poles at s = -3 and s = -6 **(08 Marks)**

c. Using RH criterion determine the stability of the system having the characteristic equation, $s^4 + 10s^3 + 36s^2 + 70s + 75 = 0$ has roots more negative than s = -2. **(08 Marks)**

PART – B

5 a. The open-loop transfer function of a feed back control system in $G(s)H(s) = \frac{K}{(s+1)(s+2)(s+3)}$, check whether the following points are on the root locus. If so, find the value of K at these points. i) s = -1.5 ii) s = -0.5 + j2 **(06 Marks)**

b. Sketch the root locus plot for a negative feed back control system characterized by an open loop transfer function, $G(s)H(s) = \frac{K}{s(s+3)(s^2+3s+11.2s)}$. Comment on stability. **(14 Marks)**

6 a. State the advantages and limitations of frequency domain approach. **(06 Marks)**

b. Determine the transfer function of a system whose asymptotic gain plot is shown in Fig. Q6 (b). **(10 Marks)**

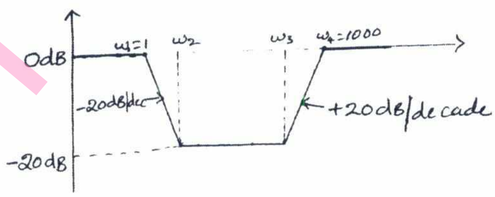

Fig. Q6 (b)

c. List the effects of lead compensation. **(04 Marks)**

7 a. Draw polar plot of $G(s)H(s) = \frac{100}{(s+2)(s+4)(s+8)}$. **(04 Marks)**

b. Explain Nyquist stability criterion. **(06 Marks)**

c. Sketch the Nyquist plot for, $GH(s) = \frac{K}{s(s+1)(s+2)}$. Then, find the range of K for closed loop stability. **(10 Marks)**

8 a. Define the following terms: i) state ii) state variables iii) state space. **(06 Marks)**

b. List the advantages of state variable analysis. **(04 Marks)**

c. Obtain the state transition matrix for, $A = \begin{bmatrix} 0 & -1 \\ 2 & -3 \end{bmatrix}$. **(10 Marks)**

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10EE44

Fourth Semester B.E. Degree Examination, December 2012
Field Theory

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. State Coulomb's law in complete form and hence derive an expression for electric field intensity. **(06 Marks)**

b. Electric charge lies in the plane at z = - 4m in the form of a square sheet described by $-2 \le x \le 2m$, $-2 \le y \le 2m$. Charge density $\rho_s = 2(x^2 + y^2 + 16)^{3/2}$ nC/m². Determine electric field intensity 'E' at origin. **(06 Marks)**

c. Using Gauss law in differential in differential form, obtain electric field intensity at, i) $0 \le r \le a_m$ ii) $r > a_m$ due to volume charge distribution ρ_V in spherical coordinates

$$\rho_v = \rho_0\left(\frac{r}{a}\right) \text{coul}/m^3 \quad 0 \le r \le a$$
$$= 0 \quad r > a$$ **(08 Marks)**

2 a. With usual notation prove that $E = -\nabla V$. **(06 Marks)**

b. A total charge of 40 nC is uniformly distributed around a ring of radius 2 m, located in a plane z = 0. The centre of the ring is at origin. Determine electric potential at (0, 0, 5) m in Cartesian coordinates. Also determine potential at (0, 0, 5) m if all charge of 40 nC were to be concentrated at the centre of ring. **(08 Marks)**

c. Obtain boundary conditions for a dielectric – dielectric boundary. **(06 Marks)**

3 a. Given $V = [Ar^4 + Br^{-4}]\sin 4\phi$ volts in cylindrical coordinates. Show that $\nabla^2 V = 0$, select A and B so that V = 100 V and $|E| = 500$ V/m at P(r = 1, $\phi = 22.5°$, z = 2) **(08 Marks)**

b. In Cartesian coordinates the potential is a function of 'x' only, at x = 2 cm, V = 25 V and $E = 1.5 \times 10^3(-a_x)$ V/m, find V at x = 3.0 cm using Laplace equation. **(05 Marks)**

c. State and prove uniqueness theorem. **(07 Marks)**

4 a. Using Biot Savert's law, determine magnetic flux density at 'P' for the current loop shown in Fig. Q4 (a), 'ρ' happens to be centre of arc as shown. **(07 Marks)**

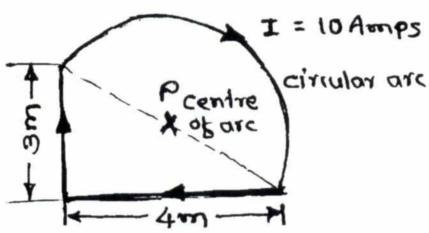

Fig. Q4 (a)

b. Given H = 20 $r^2 a_\phi$ A/m in cylindrical coordinates, i) Determine the current density J, ii) Also, determine the total current that crosses the surface r = 1 m; $0 \le \phi \le 2\pi$ and z = 0. **(06 Marks)**

c. Define vector magnetic potential and prove that $A = \int \frac{\mu_0 J dv}{4\pi R}$. **(07 Marks)**

PART – B

5 a. Two infinitely long straight conductors are located at x = 0; y = 0 and x = 0; y = 10 m. Both carry current of 10 A in positive a_z direction. Determine force experienced (per meter) between them. **(06 Marks)**

b. State and explain Lorentz force equation. **(06 Marks)**

c. A solenoid with air core has 2000 turns and a length of 5 m. Core radius is 40 mm. Determine it's inductance and derive the formula used. **(08 Marks)**

6 a. Explain Faraday's laws as applied to i) Stationary path changing field and ii) Moving circuit (path) and steady field. **(06 Marks)**

b. List Maxwell's equations for steady and time varying fields in i) point form and ii) integral form. **(08 Marks)**

c. Write a brief note on retarded potential. **(06 Marks)**

7 a. Derive general electromagnetic wave equation for a homogeneous and isotropic medium. **(08 Marks)**

b. A 15 GHz plane wave traveling in a medium has an amplitude $E_0 = 20$ V/m. Find phase velocity, wavelength propagation const and impedance. Assume $\varepsilon_r = 2$ and $\mu_r = 5$. **(08 Marks)**

c. Explain Poynting's theorem. **(04 Marks)**

8 a. Write a short note on SWR. **(05 Marks)**

b. Define the terms : i) Reflection coefficient and ii) Transmission coefficient and derive relation between them. **(08 Marks)**

c. $\overline{E}$ and $\overline{H}$ waves traveling in free space are normally incident on the interface with a perfect dielectric with $\varepsilon_r = 3$. Compute magnitudes of incident, reflected and transmitted $\overline{E}$ and $\overline{H}$ waves at the interface. **(07 Marks)**

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10EE45

Fourth Semester B.E. Degree Examination, December 2012
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. Mention and explain the different types of power electronic converter systems and also specify the form of input and output with waveforms. **(08 Marks)**

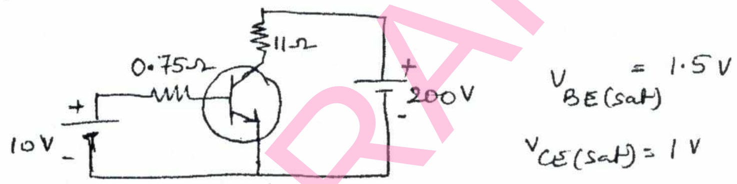
b. Explain the role of power electronic converters in i) DC-drives; ii)AC drives; iii) HVDC power transmission. **(09 Marks)**

c. What are the peripheral effects of power electronic systems? **(03 Marks)**

2 a. What is a MOSFET? Draw static and switching characteristics of MOSFET and explain the operation of MOSFET as a switch. **(12 Marks)**

b. For the transistor switch of Fig.Q.2(b), calculate: i) Forced beta, β_f of transistor; ii) If β is in the range of 8 to 40, calculate the minimum overdrive factor (ODF); iii) Obtain the power loss P_T of the transistor. **(08 Marks)**

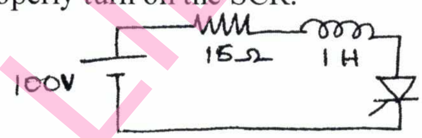
Fig.Q.2(b)



3 a. With circuit diagram and waveforms explain RC triggering technique of SCR. **(08 Marks)**

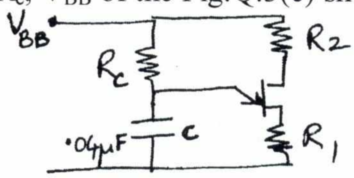
b. For the circuit shown in Fig.Q.3(b) if the latching current is 4mA, find the minimum width of gating pulse required to properly turn on the SCR. **(04 Marks)**

Fig.Q.3(b)



c. An UJT is used to trigger the thyrsitor whose minimum gate triggering voltage is 6.2 V. The UJT ratings are: $\eta = 0.66$, $I_P = 0.5$ mA, $I_V = 3$ mA, $R_{B_1} + R_{B_2} = 5K\Omega$, leakage current = 3.2 mA, V_p = 14V and U_v = 1V. Oscillatory frequency is 2 kHz and capacitor C = 0.04 μF. Determine the values of R_1, R_2, R_c, V_{BB} of the Fig.Q.3(c) shown below. **(08 Marks)**

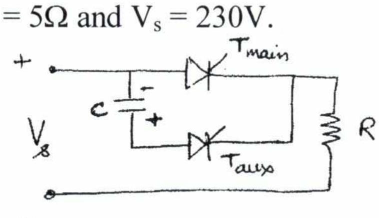
Fig.Q.3(c)



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

b. For an impulse commutated thyristor circuit shown in Fig.Q.4(b), capacitor is initially charged to V_s with polarity shown in the figure. Find the circuit turn-off time (for the main thyristor). In case C = 10μF, R = 5Ω and V_s = 230V. **(06 Marks)**

Fig.Q.4(b)



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.

c. Explain with circuit diagram and necessary waveforms, the principle of operation of class C commutation. Derive the expression for circuit turn off time. **(08 Marks)**

PART – B

5 a. With the help of a circuit diagram and waveforms explain the operation of a bidirectional controller (phase control) with R load. Derive the equation for $V_{o_{(rms)}}$. **(10 Marks)**

b. A voltage source of 230V, 50Hz supplies a resistive load of 100Ω through a pair of back to back connected thyristors (ac regulator). If both the SCRs are triggered with delay angle of 45^{o} calculate: i) $V_{o_{(rms)}}$; ii) Power dissipated; iii) RMS value of load current; iv) RMS value of thyristor current. **(10 Marks)**

6 a. With circuit diagram and relevant waveforms explain the working of a single phase half controlled bridge rectifier with resistive load and derive the expression for average and rms value of output voltage. **(10 Marks)**

b. In a 3-ϕ half controlled bridge rectifier (3-ϕ semi converters), the SCRs are triggered at a delay angle of 40^{o}. The input voltage is 440V, 3ϕ, 50 Hz. Find the average DC voltage available at the bridge terminals and also derive the formula used. **(10 Marks)**

7 a. With the help of circuit diagram, explain the working of a class-C chopper. Mention the devices that provide path for the current in each quadrant. **(10 Marks)**

b. In the chopper circuit of Fig.Q.7(b), the average output voltage is 109V. The voltage drop across the chopper switch when it is ON is $V_{Sw} = 2V$. If the load resistance R = 10Ω, f = 1.5 kHz and δ = 50%. Calculate: i) the dc input voltage to the chopper; ii) the rms output voltage; iii) the chopper efficiency; iv) the input resistance of the chopper. **(10 Marks)**

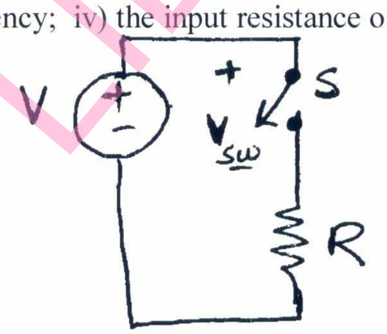


Fig.Q.7(b)

8 a. Explain with circuit diagram the operation of single phase full bridge inverter with R-L load. **(10 Marks)**

b. The single phase full bridge inverter has a resistive load of R = 2.4Ω and the DC input voltage of $V_s = 48V$. Determine:
 i) The output power.
 ii) The peak and average currents of each transistor. **(05 Marks)**

c. With relevant waveform explain sinusoidal pulse width modulation. **(05 Marks)**

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Fourth Semester B.E. Degree Examination, December 2012
Transformers and 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. What are the differences between shell type and core type transformer. **(04 Marks)**
b. Derive EMF equation of a single phase transformer. Draw the vector diagram of an practical transformer for i) Unity p.f.; ii) Lagging p.f.; iii) Leading p.f. and explain. **(10 Marks)**
c. The no-load current of a transformer is 5A at 0.3 p.f. when supplied at 230V, 50Hz. The number of turns on the primary winding is 200. Calculate: i) the maximum value of flux in the core; ii) the core loss; iii) the magnetizing current. **(06 Marks)**

2 a. Develop the equivalent circuit of a transformer referred to primary and explain. **(06 Marks)**
b. Derive the condition for maximum efficiency of a transformer. **(04 Marks)**
c. A 20 KVA, 2200/220V, 50Hz single phase transformer gave the following readings:
OC test: 220V, 4.2A, 148W (LV side open).
SC test: 86V, 10.5A, 360W (LV side shorted)
Determine:
i) The equivalent resistance and reactance referred to the secondary.
ii) The voltage regulation on full load, 0.8 p.f. lagging.
iii) The efficiency at full load and half the full load at 0.8 p.f. lagging. **(10 Marks)**

3 a. Discuss need and conditions to be satisfied for parallel operations of single phase transformers. **(04 Marks)**
b. Show that on auto-transformer will result in saving copper in place of two winding transformer. **(06 Marks)**
c. Two 100kW, 1ϕ transformers are connected in parallel both on the primary and secondary. One transformer has an ohmic drop of 0.5% and an inductive drop of 8% at full load. The other has an ohmic drop of 0.75% and an inductive drop of 4%. Show how will they share a load of 180 kW at 0.9 p.f. lagging. **(10 Marks)**

4 a. Explain with circuit diagram and phasor diagram, how two transformers connected in open delta can supply 3ϕ power successfully. **(06 Marks)**
b. Explain with neat diagram, the Scott connection of three single phase transformers to convert three phase to two phase. **(08 Marks)**
c. Two transformers connected in open delta supply a 400 KVA balanced load operating at 0.866 p.f. lagging. The load voltage is 440V. Find the :
i) KVA supplied by each transformer and
ii) KW supplied by each transformer. **(06 Marks)**

PART – B

5 a. Explain how rotating magnetic field is produced in 3ϕ induction motor. **(08 Marks)**
b. Differentiate between squirrel cage and slip ring induction motors. **(04 Marks)**
c. Draw the complete torque-slip characteristics of a 3ϕ induction motor indicating all the regions and explain. **(08 Marks)**

6 a. Explain how the performance of 3ϕ induction motor is predetermined using the circle diagram by conducting the necessary tests. **(12 Marks)**
b. A 440V, 3ϕ, 50Hz, 4 pole, star connected induction motor has a full load speed of 1425 rpm. The rotor has an impedance of (0.4 + j4) Ω per phase and rotor/stator turn ratio of 0.8. Calculate: i) Full load torque; ii) full load copper loss; iii) maximum torque and the speed at which it occurs; iv) Starting current. **(08 Marks)**

7 a. With a neat diagram, explain the construction and working operation of high starting torque rotors. **(10 Marks)**
b. Explain the working operation of induction generator, with a neat sketch. **(10 Marks)**

8 Write short notes on:
a. Star-delta starting method of 3ϕ induction motor.
b. Rotor resistance control of 3ϕ induction motor.
c. Double field revolving theory.
d. Single phase capacitor starts induction motor. **(20 Marks)**

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MATDIP401

Fourth Semester B.E. Degree Examination, December 2012

Advanced Mathematics – II

Time: 3 hrs. Max. Marks:100

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

1 a. Prove that the angle between two lines whose direction cosines are (ℓ_1, m_1, n_1) and (ℓ_2, m_2, n_2) is $\cos\theta = \ell_1\ell_2 + m_1m_2 + n_1n_2$. **(06 Marks)**

b. Find the projection of the line AB on CD where A = (1, 3, 5), B = (6, 4, 3), C = (2, -1, 4) and D = (0, 1, 5). **(07 Marks)**

c. Find the angle between any two diagonals of cube. **(07 Marks)**

2 a. Find the equation of the plane passing through the points (3, 1, 2) and (3, 4, 4) and perpendicular to $5x + y + 4z = 0$. **(06 Marks)**

b. Show that the points (0, -1, 0), (2, 1, -1), (1, 1, 1) and (3, 3, 0) are coplanar. **(07 Marks)**

c. Find the equation of the plane through the points (1, 0, -1), (3, 2, 2) and parallel to the line $\frac{x-1}{1} = \frac{1-y}{2} = \frac{z-2}{3}$. **(07 Marks)**

3 a. Find the value of λ such that the vectors $\lambda i + j + 2k$, $2i - 3j + 4k$ and $i + 2j - k$ are coplanar. **(06 Marks)**

b. If $\vec{a} = 4i + 2j - k$, $\vec{b} = 2i - j$ and $\vec{c} = j - 3k$, find (i) $(\vec{a}\times\vec{b}).(\vec{b}\times\vec{c})$, (ii) $(\vec{a}\times\vec{b})\times(\vec{b}\times\vec{c})$. **(07 Marks)**

c. Find the cosine and sine of the angle between the vectors $2i - j + 3k$ and $i - 2j + 2k$. **(07 Marks)**

4 a. Find the components of velocity and acceleration at t = 2 on the curve, $\vec{r} = (t^2+1)i + (4t-3)j + (2t^2-6t)k$ in the direction of $i + 2j + 2k$. **(06 Marks)**

b. Find the angle between the tangents to the curve $\vec{r} = \left\{t - \frac{t^3}{3}\right\}i + t^2 j + \left\{t + \frac{t^3}{3}\right\}k$ at $t = \pm 3$. **(07 Marks)**

c. Find the directional derivative of $\phi = x^2yz + 4xz^2$ at (1, -2, -1) along $2i - j - 2k$. **(07 Marks)**

5 a. If $\vec{F} = \nabla(xy^3z^2)$, find div $\vec{F}$ and curl $\vec{F}$ at the point (1, -1, 1). **(06 Marks)**

b. Show that $\vec{F} = (y+z)i + (z+x)j + (x+y)k$ is irrotational. Also find a scalar function ϕ such that $\vec{F} = \nabla\phi$. **(07 Marks)**

c. Prove that $\nabla^2(\log r) = \frac{1}{r^2}$ where $\vec{r} = xi + yj + zk$ and $r = |\vec{r}|$. **(07 Marks)**

6 a. Find Laplace transform of $(2t + 3)^2$. **(05 Marks)**

b. Find Laplace transform of $e^{2t}\cos 3t$. **(05 Marks)**

c. Find $L\left\{\frac{\cos 2t - \cos 3t}{t}\right\}$. **(05 Marks)**

d. Using Laplace transform, evaluate $\int_0^\infty e^{-2t} t \cos t \, dt$. **(05 Marks)**

7 a. Find inverse Laplace transform of $\frac{s}{s^2 + 4s + 13}$. **(06 Marks)**

b. Find $L^{-1}\left\{\frac{1}{(s^2 + 3s + 2)(s + 3)}\right\}$. **(07 Marks)**

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

8 a. Solve the differential equation $y'' + 4y' + 3y = e^{-t}$ with $y(0) = 1$ and $y'(0) = 1$ by using Laplace transforms. **(10 Marks)**

b. Solve by using Laplace transforms $\frac{dx}{dt} - 2y = \cos 2t$, $\frac{dy}{dt} + 2x = \sin 2t$ with $x = 1$, $y = 0$ at $t = 0$. **(10 Marks)**

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