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10MAT41

Fourth Semester B.E. Degree Examination, Dec.2015/Jan.2016

Engineering Mathematics – IV

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Use of statistical tables is permitted.***

PART – A

1 a. Using Taylor series method, solve the problem $\frac{dy}{dx} = x^2y - 1$, $y(0) = 1$ at the point $x = 0.2$. Consider upto 4^{th} degree terms. **(06 Marks)**

b. Using R.K. method of order 4, solve $\frac{dy}{dx} = 3x + \frac{y}{2}$, $y(0) = 1$ at the points $x = 0.1$ and $x = 0.2$ by taking step length $h = 0.1$. **(07 Marks)**

c. Given that $\frac{dy}{dx} = x - y^2$, $y(0) = 0$, $y(0.2) = 0.02$, $y(0.4) = 0.0795$, $y(0.6) = 0.1762$. Compute y at $x = 0.8$ by Adams-Bashforth predictor-corrector method. Use the corrector formula twice. **(07 Marks)**

2 a. Evaluate y and z at $x = 0.1$ from the Picards second approximation to the solution of the following system of equations given by $y = 1$ and $z = 0.5$ at $x = 0$ initially.

$$\frac{dy}{dx} = z, \quad \frac{dz}{dx} = x^3(y + z)$$ **(06 Marks)**

b. Given $y'' - xy' - y = 0$ with the initial conditions $y(0) = 1$, $y'(0) = 0$. Compute $y(0.2)$ and $y'(0.2)$ by taking $h = 0.2$ and using fourth order Runge-Kutta method. **(07 Marks)**

c. Applying Milne's method compute $y(0.8)$. Given that y satisfies the equation $y'' = 2yy'$ and y and y' are governed by the following values. $y(0) = 0$, $y(0.2) = 0.2027$, $y(0.4) = 0.4228$, $y(0.6) = 0.6841$, $y'(0) = 1$, $y'(0.2) = 1.041$, $y'(0.4) = 1.179$, $y'(0.6) = 1.468$. (Apply corrector only once). **(07 Marks)**

3 a. Derive Cauchy Riemann equations in Cartesian form. **(06 Marks)**

b. Find an analytic function $f(z) = u + iv$. Given $u = x^2 - y^2 + \frac{x}{x^2 + y^2}$. **(07 Marks)**

c. If f(z) is a regular function of z, show that $\left[\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right] |f(z)|^2 = 4\,|f'(z)|^2$ **(07 Marks)**

4 a. Find the bilinear transformation that maps the points $z = -1, i, -1$ onto the points $w = 1, i, -1$ respectively. **(06 Marks)**

b. Find the region in the w-plane bounded by the lines $x = 1$, $y = 1$, $x + y = 1$ under the transformation $w = z^2$. Indicate the region with sketches. **(07 Marks)**

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

PART – B

5 a. Solve the Laplaces equation in cylindrical polar coordinate system leading to Bessel differential equation. **(06 Marks)**

b. If α and β are two distinct roots of $J_n(x) = 0$ then prove that $\int_0^1 x\, J_n(\alpha x)\, J_n(\beta x)\, dx = 0$ if $\alpha \neq \beta$. **(07 Marks)**

c. Express the polynomial, $2x^3 - x^2 - 3x + 2$ interms of Legendre polynomials. **(07 Marks)**

6 a. State and prove addition theorem of probability. **(06 Marks)**

b. Three students A, B, C write an entrance examination. Their chances of passing are ½, ⅓, ¼ respectively. Find the probability that,
i) Atleast one of them passes.
ii) All of them passes.
iii) Atleast two of them passes. **(07 Marks)**

c. Three machines A, B, C produce respectively 60%, 30%, 10% of the total number of items of a factory. The percentages of defective outputs of these three machines are respectively 2%, 3% and 4%. An item is selected at random and is found to be defective. Find the probability that the item was produced by machine C. **(07 Marks)**

7 a. The pdf of a random variable x is given by the following table:

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

Find: i) The value of k ii) $P(x > 1)$ iii) $P(-1 < x \leq 2)$
iv) Mean of x v) Standard deviation of x. **(06 Marks)**

b. In a certain factory turning out razar blades there is a small probability of 1/500 for any blade to be defective. The blades are supplied in packets of 10. Use Poisson distribution to calculate the approximate number of packets containing, i) One defective, ii) Two defective, in a consignment of 10000 packets. **(07 Marks)**

c. In a normal distribution 31% of items are under 45 and 8% of items are over 64. Find the mean and standard deviation of the distribution. **(07 Marks)**

8 a. A sample of 100 tyres is taken from a lot. The mean life of tyres is found to be 39350 kilometers with a standard deviation of 3260. Can it be considered as a true random sample from a population with mean life of 40000 kilometers? (Use 0.05 level of significance) Establish 99% confidence limits within which the mean life of tyres expected to lie. (Given that $Z_{0.05} = 1.96$, $Z_{0.01} = 2.58$) **(06 Marks)**

b. Ten individuals are chosen at random from a population and their heights in inches are found to be 63, 63, 66, 67, 68, 69, 70, 70, 71, 71. Test the hypothesis that the mean height of the universe is 66 inches. (Given that $t_{0.05} = 2.262$ for 9 d.f.) **(07 Marks)**

c. Fit a Poisson distribution to the following data and test the goodness of fit at 5% level of significance. Given that $\psi^2_{0.05} = 7.815$ for 4 degrees of freedom.

x	0	1	2	3	4
Frequency	122	60	15	2	1

(07 Marks)

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10ES42

Fourth Semester B.E. Degree Examination, Dec.2015/Jan.2016

Microcontrollers

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With neat diagram, with the programming model of 8051 with addresses of SFR's and ports. Also give 128 bytes RAM allocation. **(12 Marks)**

b. Interface 8051 to 8K external RAM and 32K external ROM and explain how 8051 access them? **(08 Marks)**

2 a. Explain difference addressing modes of 8051. Give an example for each of them and mention limitations of each. **(07 Marks)**

b. Explain the following instruction of 8051 with example (values).
i) XCHD A_1 @ Ri ii) MOVC A_1 @ A + PC iii) SWAP A
iv) RL A v) MUL AB vi) DA A **(09 Marks)**

c. Examine the following code and analyse the result with flag register. Content
MOV A_1 # – 30d
MOV R_2, # – 50d
ADD A, R_2 **(04 Marks)**

3 a. Explain the different types of conditional and unconditional jump instruction of and unconditional jump instruction of 8051. Specify the difference range associated with jump instruction. **(08 Marks)**

b. Classify the CALL instruction in 8051. Explain each one. **(06 Marks)**

c. Write a program to generate and store Fibonacci terms, which are less then FFh. **(06 Marks)**

4 a. What are assembler directives? Explain any four of them. **(05 Marks)**

b. Write a program to find LCM (List Common Multiplier) of two number m_1 and m_2. **(09 Marks)**

c. Explain C data types for 8051 with their data size in bits and data range. **(06 Marks)**

PART – B

5 a. Explain TMOD and TCON register of 8051 timers. **(10 Marks)**

b. For every 50 chocolates, vending machine is getting heated up, it requires minimum of 1sec break after every 50 chocolates. Provide solution for this real time problem. **(10 Marks)**

6 a. What is baud rate? Which timer of the 8051 is used to set the baud rate? **(04 Marks)**

b. Explain SCON register with its bit pattern. **(08 Marks)**

c. Write a 8051 program to send the data message " MICROCONTROLLERS " of the length 17 character at a baud rate 2400, 8bit data, 1stop bit serially. **(08 Marks)**

7 a. Compare polling and Interrupt. Explain the six interrupt of 8051, with primary and interrupt vector table. **(08 Marks)**

b. Write a program to move stepper motor by 20steps is anticlockwise direction interface. **(08 Marks)**

c. Explain the advantages of interfacing 8255 with 8051 μc. **(04 Marks)**

8 a. Explain MSP430 architecture with neat block diagram. **(08 Marks)**

b. Explain memory address space of MSP430 with neat diagram. **(04 Marks)**

c. Write ALP to find larger element in a block of data using MSP430. **(08 Marks)**

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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.

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10ES43

Fourth Semester B.E. Degree Examination, Dec.2015/Jan.2016
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. Briefly explain the requirements of a good control system. **(06 Marks)**

b. Show that the two systems shown in Fig.Q1(b)(i) and Fig.Q1(b)(ii) are analogous system by comparing their transfer functions. **(06 Marks)**

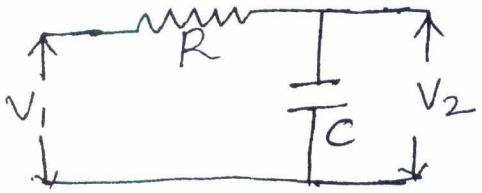

Fig.Q1(b)(i)

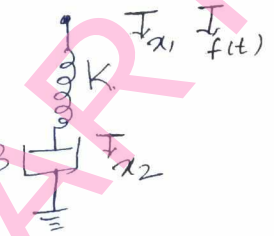

Fig.Q1(b)(ii)

c. For the mechanical system shown in Fig.Q1(c), i) Draw the mechanical network ii) write the differential equations iii) draw force – voltage analogous electric network. **(08 Marks)**

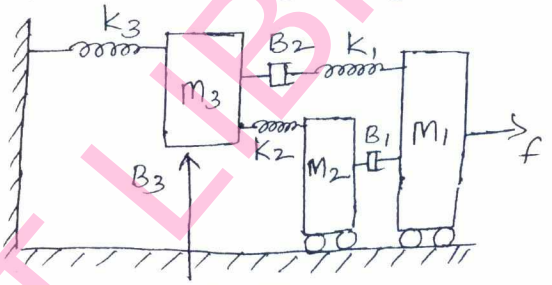

Fig.Q1(c)

2 a. Illustrate how to perform the following in connection with block diagram reduction techniques.
i) Shifting take – off point after a summing point
ii) Shifting take – off point before a summing point
iii) Removing minor feedback loop. **(06 Marks)**

b. What is signal-flow graph representation? Briefly explain the properties of signal flow graph. **(06 Marks)**

c. Draw a block diagram for the electric circuit shown in Fig.Q2(c) and obtain the transfer function $\frac{E_0(s)}{E_i(s)}$. **(08 Marks)**

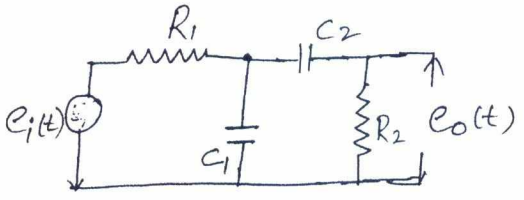

Fig.Q2(c)

3 a. Show that the steady state error $e_{ss} = \lim_{s\to 0} \frac{SR(s)}{1+G(s)H(s)}$ using simple closed loop system with –ve feedback. **(06 Marks)**

b. The block diagram of a simple servo system is shown in Fig. Q3(b). Compute the values of K and T to give overshoot of 20% and peak time of 2 sec. **(06 Marks)**

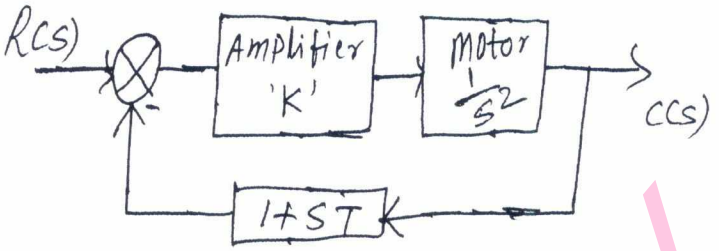

Fig.Q3(b)

c. Referring to Fig.Q3(c), find the following : i) transfer function : $\frac{X(s)}{F(s)}$ ii) ξ, W_n iii) % M_p, T_s and T_p. where K = 33 N/m, B = 15 N – s/m, M = 3 kg. **(08 Marks)**

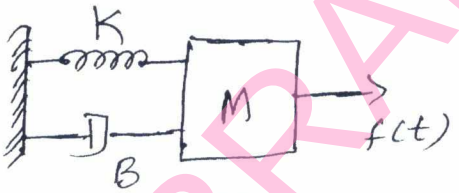

Fig.Q3(c)

4 a. What is stable and unstable systems? What is the difference between absolute and relative stable systems? **(06 Marks)**

b. A unity feedback control system has $G(S) = \frac{K(s+13)}{s(s+3)(s+7)}$, using Routh's criterion calculate the range of K for which the system has its closed loop poles more negative than –1. **(06 Marks)**

c. The open loop transfer function of a unity feedback, open loop control system is given by $G(s) = \frac{K(s+10)}{s^2(s^2+2s+10)}$, i) find the value of K so that the steady state error for a unity parabolic input is ≤ 0.1 ii) for the value of K found in part i) verify the closed loop system is stable or not. **(08 Marks)**

PART – B

5 a. Consider the system with $G(s)H(s) = \frac{K}{s(s+2)(s+4)}$, find whether s = – 0.75 and s = –1 + j4 is on the root locus using angle condition. **(04 Marks)**

b. For a system having $G(s)H(s) = \frac{K}{s(s+3)(s^2+3s+11.25)}$. Find the valid break away points and angle of departure. **(06 Marks)**

c. Show that the part of the root locus of a system with $G(s)H(s) = \frac{K(s+3)}{s(s+2)}$ is a circle having center (–3, 0) and radius at $\sqrt{3}$.(Using both graphical and analytical method). **(10 Marks)**

6 a. List the advantages and limitations of frequency domain approach. **(04 Marks)**

b. What is lead and lag network? List the effects of lead and lag compensator. **(06 Marks)**

c. For a control system having $G(s) = \frac{k(1+0.5s)}{s(1+2s)(1+0.05s+0.125s^2)}$, draw bode plot, with K = 4 and find gain margin and phase margin. **(10 Marks)**

7 a. Draw polar plot of :

$$G(s)H(s) = \frac{100}{(s+2)(s+4)(s+8)}.$$ **(06 Marks)**

b. State and explain Nyquist stability criterion. **(04 Marks)**

c. For the given system $G(s) = \frac{10}{s^2(1+0.25s)(1+0.5s)}$ sketch the Nyquist plot and determine whether the system is stable or not. **(10 Marks)**

8 a. Construct the state model using phase variables if the system is described by the differential equation : $\frac{d^3y(t)}{dt^3} + \frac{4d^2y(t)}{dt^2} + \frac{7dy(t)}{dt} + 2y(t) = 5u(t)$. Draw the state diagram. **(06 Marks)**

b. List the properties of the state transition matrix. **(06 Marks)**

c. Obtain the state transition matrix for : $A = \begin{bmatrix} 0 & -1 \\ 2 & -3 \end{bmatrix}$. **(08 Marks)**

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10EE44

Fourth Semester B.E. Degree Examination, Dec.2015/Jan.2016

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. Explain the terms "electric field intensity" and derive expression for field due to infinite line of charge. **(08 Marks)**

b. Use Gauss law to determine electric field intensity due to infinite line charge. **(06 Marks)**

c. The flux density $\overline{D} = \frac{r}{3}\,\overline{a}_r$ nc / m^2 is in the free space.

i) Find $\overline{E}$ at r = 0.2m
ii) Find the total Electric flux leaving the sphere of r = 0.2m
iii) Find the total charge within the sphere of r = 0.3m. **(06 Marks)**

2 a. Show that the energy required to assemble 'n' number of point changes is $W_E = \frac{1}{2}\sum_{m=1}^{n} Q_m V_m$ and hence derive expression form energy in electric field in terms of field quantities $\overline{D}$ and $\overline{E}$. **(08 Marks)**

b. Potential is given by $V = 2(x+1)^2 (y+2)^2 (z+3)^2$ volts in free space. At a point P(2, -1, 4). Calculate i) Potential ii) Electric field intensity iii) Flux density and iv) Volume charge density. **(06 Marks)**

c. Find the work done in moving a charge of +2C from (2, 0, 0)m to (0, 2, 0)m along the straight line path joining two points, if the electric field is $\overline{E} = \left(12x\overline{a}_x - 4y\overline{a}_y\right)$ v/m. **(06 Marks)**

3 a. Arrive at the Poisson's equation in Cartesian coordinates. Deduce Laplace's equation from Poisson's equation. **(06 Marks)**

b. Verify that the potential field $V = 2x^2 - 3y^2 + z^2$ satisfies the Laplace's equation. **(06 Marks)**

c. Using Laplace equation, derive the expression for the capacitance of a co – axial cable. **(08 Marks)**

4 a. State and explain Biot – Savart's law. Using this, find the magnetic field intensity in the vicinity of an infinitely long, straight, filamentary current I Amperes along Z – axis. **(08 Marks)**

b. Discuss the concept of vector magnetic potential and hence show that $\overline{A} = \frac{\mu_0}{4\pi}\int \frac{\overline{J}}{4} dv$ where $\overline{A}$ is the vector magnetic potential and $\overline{J}$ is the current density. **(06 Marks)**

c. At a point P(x, y, z) the components of vector magnetic potential $\overline{A}$ are given as $A_x = 4x + 3y + 2z$, $A_y = 5x + 6y + 3z$ and $A_z = 2x + 3y + 5z$. Determine $\overline{B}$ at point P and state its nature. **(06 Marks)**

PART – B

5 a. State and explain the Lorentz force equation. **(06 Marks)**

b. A conductor 4m long lies along the y – axis with a current of 10A in the $\bar{a}_y$ direction. Find the force on the conductor if the field in the region is $\bar{B} = 0.005\,\bar{a}_x$, Tesla. **(06 Marks)**

c. Discuss the boundary conditions at the interface between two media of different permeabilites. **(08 Marks)**

6 a. Show that

$$\nabla \bullet \bar{J} = \frac{-\partial \rho v}{\partial t}$$

Where $\bar{J}$ = conduction current density A/m^2

ρ = volume charge density in cm^3 **(08 Marks)**

b. Find the induced voltage in the conductor if $\bar{B} = 0.04\,\bar{a}_y$ T and $\bar{V} = 2.5 \sin 10^3 t\,\bar{a}_z$ m/s

Find induced e.m.f if $\bar{B}$ is changed to $0.04\,\bar{a}_x$ T. **(12 Marks)**

7 a. Derive the wave equation starting from Maxwell's equation for free space. **(10 Marks)**

b. A lossy dielectric has $\mu_r = 1$, $\varepsilon_r = 50$ and $\sigma = 60$ ℧/m at 15.9MHz. Find α, β, V and η if the uniform plane wave is travelling through the medium. **(10 Marks)**

8 a. Derive the expression for transmission coefficient and reflection coefficient. **(10 Marks)**

b. With necessary expression, explain standing wave ratio. **(10 Marks)**

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10EE45

Fourth Semester B.E. Degree Examination, Dec.2015/Jan.2016
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 neat circuit diagrams and waveforms, explain the operation of various types of power electronic circuits. **(12 Marks)**

b. With a neat sketch, explain the operation of HVDC power transmission system. **(08 Marks)**

2 a. With neat circuit diagram, and switching times, explain switching characteristics of power BJT. **(12 Marks)**

b. In the Bipolar transistor circuit shown in Fig. Q2(b), β varies between 8 to 40. The load resistance R_C = 11 Ω, V_{CC} = 200 volts, V_B = 10 volts. If $V_{CE(sat)}$ = 1 volt, and $V_{BE(sat)}$ = 1.5 volts, determine : i) The value of R_B such that it results in saturation with ODF of 5, ii) the forced B_f, iii) the power loss P_T in the transistor. **(08 Marks)**

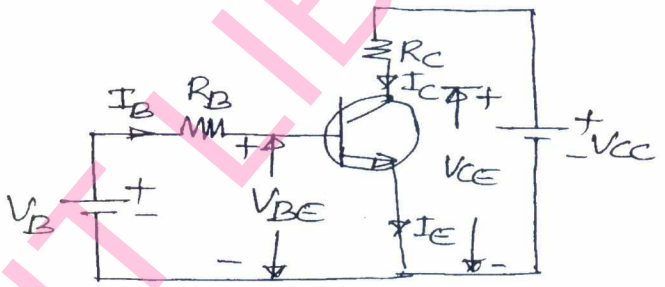

Fig.Q2(b)

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

b. With a neat circuit explain the series operation of thyristors. **(08 Marks)**

c. A SCR circuit operates from 300 volts DC supply, has series inductance of 4 μH, a resistance of 4Ω and capacitance of 0.2 μF is connected across the SCR. Calculate the maximum permissible di/dt and dv/dt values. **(04 Marks)**

4 a. With a neat circuit diagram and waveforms, explain the working of self commutation. **(08 Marks)**

b. The impulse commutation has c = 20 μF, L_1 = 25 μH. The initial capacitor voltage is equal to the input voltage, where $V_0 = V_s$ = 200 volts, If the load current I_m is 50 Amps, determine the circuit turnoff time t_{off}. Derive the equations used. **(08 Marks)**

c. The complementary commutation circuit has load resistances of $R_1 = R_2 = R$ = 5 Ω, C = 10μF and supply voltage V_S = 100 volts. Determine the circuit turnoff time. **(04 Marks)**

PART – B

5 a. With a neat circuit diagram, quadrant and waveforms, explain the operation of single phase controlled thyristor converter with a resistive load. **(08 Marks)**

b. With a neat circuit diagram, quadrant and waveforms, explain the working of three phase half-wave converter with a resistive load. **(07 Marks)**

c. A single phase semi converter is operated from 120 V rms, 50 Hz AC supply. The load resistance is 10 Ω. If the average output voltage is 25% of the maximum possible average output voltage, determine :
   i) firing angle
   ii) rms and average output current. **(05 Marks)**

6 a. With a neat circuit diagram and waveform, explain the working of step up chopper. Derive the expression for its average output voltage interms of duty ratio. **(07 Marks)**

b. With a neat circuit diagram, polarities, conducting devices, explain the operation of class – E chopper. **(09 Marks)**

c. A step down chopper has a resistive load of 20 Ω and the input voltage is V_s = 220 volts. When the chopper is on, its voltage drop is 1.5 volts and chopping frequency is 10 KHz. If duty cycle is 80%, determine :
   i) the average output voltage
   ii) rms output voltage. **(04 Marks)**

7 a. With a neat circuit diagram and waveforms, explain the operation of single phase full bride inverter. **(06 Marks)**

b. Explain the performance parameters of an inverter. **(06 Marks)**

c. With a neat circuit diagram and waveforms, explain 120° mode of operation of a three phase inverter. **(08 Marks)**

8 a. With the help of a schematic circuit and waveforms, explain the principle of ON-OFF control. Mention the equation for output voltage. **(08 Marks)**

b. Describe how the power electronic converters produce electromagnetic interference. How this interference is minimized? **(08 Marks)**

c. A single phase fullwave AC voltage controller has a resistive load of R = 10 Ω, V_S = 120 V (rms). The delay angles of thryristors T_1 and T_2 are equal, $\alpha_1 = \alpha_2 = \alpha = \pi/2$.
Determine :
   i) the rms output voltage V_0 and
   ii) the input power factor pF. **(04 Marks)**

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10EE46

Fourth Semester B.E. Degree Examination, Dec.2015/Jan.2016
Transformer 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. Derive EMF equation of a single phase transformer. Draw the vector diagram of a practical transformer for leading power factor. **(08 Marks)**

b. Distinguish between core type and shell type transformers. **(07 Marks)**

c. An ideal 25 KVA transformer has 500 turns on primary winding and 40 turns of secondary winding primary is connected to 3000V, 50 Hz supply, calculate :
i) Full load primary and secondary current
ii) Secondary induced emf
iii) Maximum flux in the core. **(05 Marks)**

2 a. Explain how the flux in the core of transformer remains constant, from no load to full load. Develop the phasor diagram of an actual transformer when it is inductively loaded. **(07 Marks)**

b. Find the all day efficiency of a transformer having maximum efficiency of 98% at 15 KVA at upf and loaded as follows :
2 KW at 0.5 pf lag for 12 Hrs
12 KW at 0.8 pf lag for 6 Hrs
No load for 6 Hrs. **(06 Marks)**

c. The results obtained from open circuit and short circuit tests on 10 KVA, 450/120V, 50 Hz transformer are :

O.C. test	120 V	4.2 A	80 W	Instruments placed on lv side
S.C. test	9.65 V	22.2 A	120 W	With lv winding short circuited

Compute :
i) Equivalent circuit constants
ii) Efficiency and voltage regulation at full load 0.8 pf lag
iii) Efficiency at half full load and 0.8 lagging pf. **(07 Marks)**

3 a. Derive an equation for KVA sharing of both the transformer when they are connected in parallel, assuming both transformer have equal voltages ratio. Also mention the conditions for parallel connection. **(06 Marks)**

b. Explain working of auto transformer and show the copper required for auto transformer is less in comparison with two winding transformer for the same rating **(06 Marks)**

c. With the help of relevant circuit diagram, explain back to back test. Mention the advantages of this test. **(08 Marks)**

4 a. Show that open delta connection of 3 phase transformers has KVA rating of 58% of that of delta–delta connection. **(05 Marks)**

b. Explain with circuit diagram and phasor diagram the method of conversion of 3 phase to 2 phase supply. Show that load is balanced on both sides. **(10 Marks)**

c. Two 100V, 1 phase furnaces take loads of 600 KW and 900 KW respectively at a power factor of 0.707 lagging and are supplied from 6600V, 3 phase supply through a scott connected transformer. Calculate the line currents in the 3 phase side. **(05 Marks)**

PART – B

5 a. Explain the concept of rotating magnetic field and hence, explain the principle of operation of 3–phase induction motor. **(10 Marks)**

b. Sketch the torque–slip characteristic of a 3-phase induction motor indicating there in the starting torque, maximum torque and operating region. **(04 Marks)**

c. An 18.65 KW, 4 pole 50 Hz, 3–phase induction motor has a friction and windage losses of 2.5% of output. The full load slip is 4%, calculate :

i) The rotor copper loss
ii) The rotor input
iii) Shaft torque
iv) The gross electromagnetic torque for full load. **(06 Marks)**

6 a. Explain the phenomenon of cogging and crowling in 3 - ϕ induction motor. **(08 Marks)**

b. Draw the circle diagram from no load and short circuit test of a three phase, 20 HP (14.92 KW), 400V, 6 pole induction motor from the following results. (line values) no load test : 400 V, 09A, cos ϕ = 0.2, short circuit test : 200 V, 50 A, cos ϕ = 0.4
From the diagram, Find :

i) Line current and power factor at full load
ii) The maximum HP
iii) Maximum torque. Assume stator and rotor copper losses are equal at standstill. **(12 Marks)**

7 a. With a neat sketch, explain the working of a double–cage induction motor. Draw its equivalent circuit. **(10 Marks)**

b. Explain the working operation of induction generator, with a neat sketch. **(10 Marks)**

8 a. Explain the following speed control methods of 3–phase induction motor :

i) Stator voltage control
ii) Rotor resistance control. **(06 Marks)**

b. Why single phase induction motor is not self starting? Explain the double revaluing field theory. **(08 Marks)**

c. What is the necessity of starter for a 3 – phase induction motor? Explain the star- delta starter. **(06 Marks)**

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MATDIP401

Fourth Semester B.E. Degree Examination, Dec.2015/Jan.2016

Advanced Mathematics – II

Time: 3 hrs. Max. Marks:100

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

1 a. Find the direction cosines of the line which is perpendicular to the lines with direction cosines (3, -1, 1) an (-3, 2, 4). **(06 Marks)**

b. If $\cos\alpha$, $\cos\beta$, $\cos\gamma$ are the direction cosines of a line, then prove the following:

i) $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$

ii) $\cos 2\alpha + \cos 2\beta + \cos 2\gamma = -1$ **(07 Marks)**

c. Find the projection of the line AB on the line CD where A = (1, 2, 3), B = (1, 1, 1), C = (0, 0, 1), D = (2, 3, 0). **(07 Marks)**

2 a. Find the equation of the plane through (1, -2, 2), (-3, 1, -2) and perpendicular to the plane $2x - y - z + 6 = 0$. **(06 Marks)**

b. Find the image of the point (1, -2, 3) in the plane $2x + y - z = 5$. **(07 Marks)**

c. Find the shortest distance between the lines $\frac{x-8}{3} = \frac{y+9}{-16} = \frac{z-10}{7}$ and $\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$. **(07 Marks)**

3 a. Find the constant 'a' so that the vectors $2i - j + k$, $i + 2j - 3k$ and $3i + aj + 5k$ are coplanar. **(06 Marks)**

b. Prove that $\left[\vec{a}+\vec{b},\ \vec{b}+\vec{c},\ \vec{c}+\vec{a}\right] = 2\left[\vec{a},\vec{b},\vec{c}\right]$. **(07 Marks)**

c. Find the unit normal vector to both the vectors $4i - j + 3k$ and $-2i + j - 2k$. Find also the sine of the angle between them. **(07 Marks)**

4 a. A particle moves along the curve $x = t^3 + 1$, $y = t^2$, $z = 2t + 5$ where t is the time. Find the components of its velocity and acceleration at time t = 1 in the direction of $2i + 3j + 6k$. **(06 Marks)**

b. Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $x = z^2 + y^2 - 3$ at the point (2, -1, 2). **(07 Marks)**

c. Find the directional derivative of $\phi = xy^2 + yz^3$ at the point (1, -2, -1) in the direction of the normal to the surface $x\log z - y^2 = -4$ at (-1, 2, 1). **(07 Marks)**

5 a. Prove that $\text{div}(\text{curl}\,\vec{A}) = 0$. **(06 Marks)**

b. Find $\text{div}\,\vec{F}$ and $\text{curl}\,\vec{F}$ where $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$. **(07 Marks)**

c. Show that the vector $\vec{F} = (3x^2 - 2yz)i + (3y^2 - 2zx)j + (3z^2 - 2xy)k$ is irrotational and find ϕ such that $\vec{F} = \text{grad}\,\phi$. **(07 Marks)**

6 a. Find: $L\{\cos t \cos 2t \cos 3t\}$. **(06 Marks)**

b. Find: i) $L\{e^{-t}\cos^2 t\}$, ii) $L\{te^{-t}\sin 3t\}$. **(07 Marks)**

c. Find: $L\left\{\frac{\cos at - \cos bt}{t}\right\}$. **(07 Marks)**

7 a. Find: $L^{-1}\left\{\frac{4s+5}{(s-1)^2(s+2)}\right\}$. **(06 Marks)**

b. Find: i) $L^{-1}\left\{\frac{s+2}{s^2-4s+13}\right\}$, ii) $L^{-1}\left\{\log\left(\frac{s+a}{s+b}\right)\right\}$. **(07 Marks)**

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

8 a. Using Laplace transforms, solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^{2t}$ with $y(0) = 0$, $y'(0) = 1$. **(10 Marks)**

b. Using Laplace transformation method solve the differential equation $y'' + 2y' - 3y = \sin t$, $y(0) = y'(0) = 0$. **(10 Marks)**

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