USN | | | | | | | | | | |

10MAT41

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
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. Use Picards method to obtain the solution of $\frac{dy}{dx} = e^x - y$, $y(0) = 1$ and hence find $y(0.2)$ considering upto third approximation. **(06 Marks)**

b. Using Runge-Kutta method of fourth order find $y(0.2)$ for the equation $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$ taking $h = 0.2$. **(07 Marks)**

c. Find $y(0.2)$ using modified Euler's method correct to four decimal places for the equation $\frac{dy}{dx} = x - y^2$, $y(0) = 1$, taking $h = 0.1$. **(07 Marks)**

2 a. Solve $\frac{dy}{dx} = 1 + zx$, $\frac{dz}{dx} = -xy$ with $y(0) = 0$, $z(0) = 1$ at $x = 0.3$ by applying Runge-Kutta method of fourth order. **(06 Marks)**

b. Obtain the solution of the equation $2y'' = 4x + y'$ with initial conditions $y(1) = 2$, $y(1.1) = 2.2156$, $y(1.2) = 2.464$, $y(1.3) = 2.7514$ and $y'(1) = 2$, $y'(1.1) = 2.3178$, $y'(1.2) = 2.6725$ and $y'(1.3) = 3.0657$ by computing $y(1.4)$ applying Milne's method. **(07 Marks)**

c. Use Picard's method to obtain the second approximation to the solution of $\frac{d^2y}{dx^2} - x^3\frac{dy}{dx} - x^3y = 0$ given $y(0) = 1$, $y'(0) = \frac{1}{2}$ and hence find $y(0.1)$. **(07 Marks)**

3 a. State and prove Cauchy-Riemann equations in polar form. **(06 Marks)**

b. Find the analytic function $f(z)$ whose imaginary part is $\left(r - \frac{k^2}{r}\right)\sin\theta$, $r \neq 0$ and hence find the real part of $f(z)$. **(07 Marks)**

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

4 a. Find the image of the triangular region bounded by the lines $x = 1$, $y = 1$, $x + y = 1$ under the transformation $W = Z^2$. **(07 Marks)**

b. If $f(z)$ is analytic within and on C (simple closed curve) and 'a' is a point within 'c' prove that $f(a) = \frac{1}{2\pi i}\int_C \frac{f(z)}{z-a}dz$. **(06 Marks)**

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

PART – B

5 a. Obtain the series solution of Bessel's differential equation. **(07 Marks)**

b. Derive the Rodrigues formula. **(06 Marks)**

c. If $x^3 + 2x^2 - x + 1 = aP_0(x) + bP_1(x) + cP_2(x) + dP_3(x)$ using Rodrigue's formula find the values of a, b, c, d. **(07 Marks)**

6 a. If A and B are events with $P(A) = \frac{1}{2}$, $P(A \cup B) = \frac{3}{4}$, $P(\overline{B}) = \frac{5}{8}$ find $P(A \cap B)$, $P(\overline{A} \cap \overline{B})$, $P(\overline{A} \cup \overline{B})$ and $P(\overline{A} \cap B)$. **(06 Marks)**

b. In a college boys and girls are equal in proportion. It was found that 10 out of 100 boys and 25 out of 100 girls were referring same author text book. If a student using that was selected at random, what is the probability of being a boy? **(07 Marks)**

c. A bag contains three coins, one of which is two headed and the other two are normal and fair. A coin is chosen at random from the bag and tossed four times in Succession if head turns up each time, what is the probability that this is the two headed coin. **(07 Marks)**

7 a. Find the value of 'K' such that the following distribution represents a finite probability distribution. Hence find the mean (μ) and standard deviation (σ). Also find $P(X \leq 1)$, $P(X>1)$ and $P(-1 < X \leq 2)$. **(06 Marks)**

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

b. If the mean and standard deviation of the number of correctly answered questions in a test given to 4096 students are 2.5 and $\sqrt{1.875}$, find an estimate of the number of candidates answering correctly (i) 8 or more questions (ii) 2 or less (iii) 5 questions. **(07 Marks)**

c. Derive the expressions for the mean and standard deviation of exponential distribution. **(07 Marks)**

8 a. Certain tubes manufactured by a company have mean life time of 800 hours and standard deviation of 60 hours. Find the probability that a random sample of 16 tubes taken from the group will have mean life time, (i) between 790 hours and 810 hours. (ii) less than 785 hours. **(06 Marks)**

b. Two horses A and B were tested according to the time (in seconds) to run a particular race with the following result.

Horse A:	28	30	32	33	29	34
Horse B:	29	30	30	24	27	29

Test whether you can discriminate between the two horses. Use $t_{0.05} = 2.2$ and $t_{0.02} = 2.72$ **(07 Marks)**

c. A die is thrown 264 times and the number appearing on the face (x) follows the frequency distribution as mentioned below:

x	1	2	3	4	5	6
f	40	32	28	58	54	60

Calculate the value of χ^2. **(07 Marks)**

* * * * *

USN | | | | | | | | | | |

10ES42

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Microcontrollers

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Differentiate between a microprocessor and a microcontroller. **(06 Marks)**

b. With the neat sketch of 8051 architecture, explain the CPU registers. **(08 Marks)**

c. With the help of timing diagram, explain how to interface 8K EPROM and 4K RAM to 8051. **(06 Marks)**

2 a. Write a program to swap the contents of Registers R_7 and R_6 in register block 0, in four different ways. **(06 Marks)**

b. List bit level logical instructions and their operation in 8051. **(08 Marks)**

c. Explain different ranges for Jump instruction available in 8051 microcontroller. **(06 Marks)**

3 a. Write a program to exchange the lower nibble of data present in external memory 6000H and 6001H. **(06 Marks)**

b. An 8-bit code word is stored in location 1000H of external data memory. Code word is valid, if three MSB's are zero and it contains two ones in the remaining five bits. If code word is valid, store FF, else store OO in 1001H. **(08 Marks)**

c. Write a program to blink the LED's alternatively connected to port 0 with a delay of 1 mS. Assume XTAL = 12 MHz. **(06 Marks)**

4 a. Write the circuit diagram for port 0, explain the operations of 8051 using port 0. **(06 Marks)**

b. Show a simple keyboard interface with port of 8051 and explain its operation. **(08 Marks)**

c. Write a program to rotate a stepper motor 64° in the clockwise direction. The motor has a step angle of 2°. **(06 Marks)**

PART – B

5 a. Explain IE and IP registers with its bit pattern. **(06 Marks)**

b. Explain different modes of operation of timer/counter of 8051 with relevant block diagram and steps to program the modes. **(08 Marks)**

c. Write an Assembly (or) C-program to generate a frequency of 100 Hz square wave, using timer 0 in mode-1. Assume crystal frequency = 11.0592 MHz (Assume any pin number). **(06 Marks)**

6 a. Write an 8051 program to send the message of "SAVE POWER" to the serial port continuously. Assume XTAL = 11.0592 MHz, 9600 baud rate, 8-bit data and one stop bit. **(06 Marks)**

b. Explain RS-232 hand shaking signals and specify the purpose of Max – 232 while interfacing. **(08 Marks)**

c. Explain the control word of 8255A. **(06 Marks)**

7 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 MSP430 assembly program to find the largest in the given array of 'n' bytes. **(06 Marks)**

8 Write short note on with respect to MSP430:

a. Watch dog timer.

b. Real Time Clock (RTC).

c. Significance of Gate in Tmode Register of 8051.

d. Internal RAM structure of 8051. **(20 Marks)**

* * * * *

USN | | | | | | | | | | |

10ES43

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
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. Define and compare open loop control system with closed loop control system with an example. **(06 Marks)**

b. Obtain the differential equation for the Fig. Q1 (b) shown in Fig. Q1 (b). **(04 Marks)**

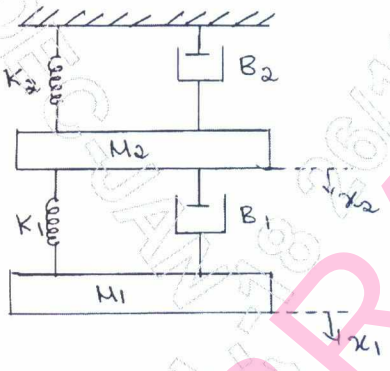

Fig. Q1 (b)

c. Obtain the differential equation describing the system shown in the Fig. Q1 (c) and also sketch the electrical circuit based on, (i) Torque voltage analogy (ii) Torque current analogy. **(10 Marks)**

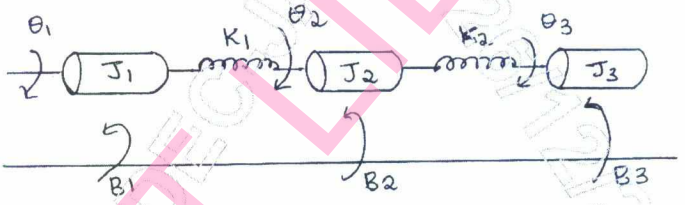

Fig. Q1 (c)

2 a. Define the following terms:
(i) Self loop (ii) Node (iii) Branch (iv) Feedback loop. **(04 Marks)**

b. Simplify the block diagram shown in the Fig. Q2 (b) below, also obtain he closed loop transfer function $C(s)/R(s)$. **(08 Marks)**

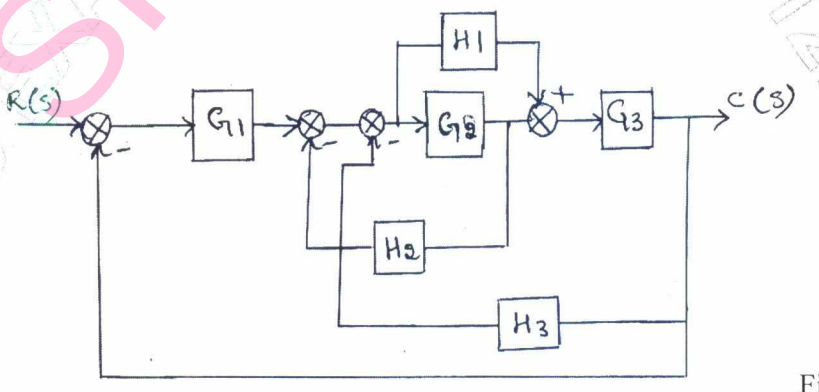

Fig. Q2 (b)

c. Find the overall transfer function by using Mason's gain formula for Fig. Q2 (c) shown below. **(08 Marks)**

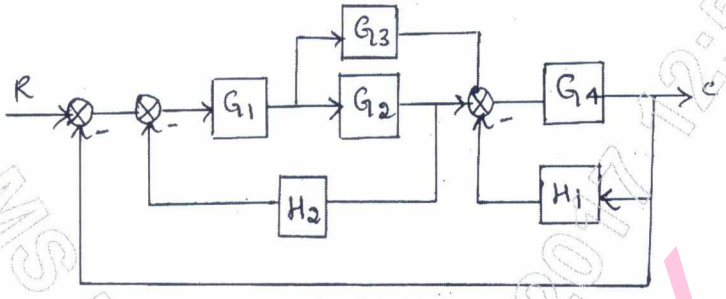

Fig. Q2 (c)

3 a. Explain the following time domain specification of a 2nd order system,
(i) Rise time (ii) Delay time (iii) Peak time (iv) Peak overshoot. **(06 Marks)**

b. For a system shown in Fig. Q3 (b), find the value of 'A' such that damping ratio is 0.5, determine the values of Tr, T_P, M_P and T_S in the unit step response. **(08 Marks)**

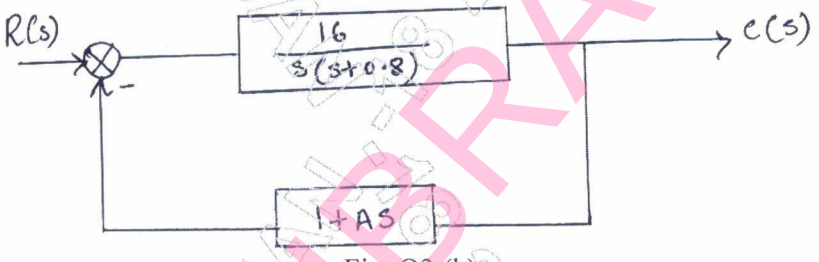

Fig. Q3 (b)

c. For a system shown in the Fig. Q3 (c) below determine steady state error for a unit step input given to the system. **(06 Marks)**

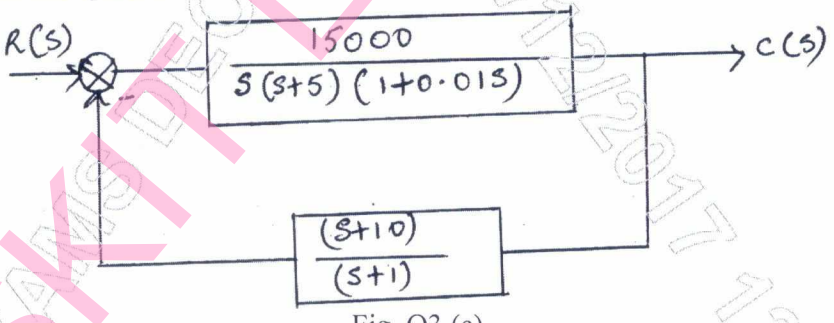

Fig. Q3 (c)

4 a. What are the necessary conditions and limitations for the system to be stable in case of Routh Hurwitz criterion? **(06 Marks)**

b. Examine the stability of Routh criterion $s^5 + s^4 + 2s^3 + 2s^2 + 3s + 5 = 0$. **(06 Marks)**

c. The open loop transfer function of a unity feedback control system is given by,

$$G(s)H(s) = \frac{K}{s(s+1)(2s+1)(3s+1)}$$

Determine the values of 'K'.

(i) For which the system is stable.

(ii) Which will cause the sustained oscillation in closed loop system and frequency of sustained oscillations? **(08 Marks)**

PART – B

5 a. What is Root locus? State the different rules for construction of root loci? **(08 Marks)**

b. For a unity feedback system $G(s) = \frac{K}{s(s+4)(s+2)}$. Sketch the root locus showing all the details on it. **(12 Marks)**

6 a. State and explain Nyquist stability criterion. **(08 Marks)**

b. Sketch the Nyquist plot and comment on closed loop stability of a system whose open loop transfer function is,

$$G(s)H(s) = \frac{10}{s(s+2)(s+1)}$$ **(12 Marks)**

7 a. Define the following terms:

(i) Gain cross over frequency (ii) Gain margin

(iii) Phase cross over frequency (iv) Phase margin **(08 Marks)**

b. A unity feedback control system has $G(s) = \frac{80}{s(s+2)(s+20)}$. Draw the Bode plot. Determine GM, PM, ω_{gc} and ω_{pc}. Comment on the stability. **(12 Marks)**

8 a. Define the following terms:

(i) State

(ii) State variable

(iii) State space **(06 Marks)**

b. Obtain the state space representation of the following system given by,

$$\frac{Y(s)}{U(s)} = \frac{2(s+3)}{(s+1)(s+2)}$$

Find the partial fraction of it. **(07 Marks)**

c. Obtain phase variable representation for a system whose transfer function is given by,

$$\frac{Y(s)}{u(s)} = \frac{6s^3 + 4s^2 + 3s + 10}{s^3 + 8s^2 + 4s + 20}$$ **(07 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE44

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Field Theory

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting atleast TWO questions from each part.*
2. Missing data, if any, may be suitably assumed.

PART – A

1 a. State and explain Coulomb's law for electrostatic force between two point charges. Represent force in vector form. **(05 Marks)**

b. Find electric flux density in Cartesian co-ordinate system at a point (6, 8, –10) due to :
i) A point charge of 60mc at the origin
ii) A uniform surface charge of density $\rho_S = 100\ \mu c/mt^2$ on the plane x = 12mt. **(08 Marks)**

c. Given the electric flux density $\vec{D} = 5\sin\theta\,\hat{a}_\theta + 5\sin\phi\,\hat{a}_\phi$, find the charge density of (0.7m, $\pi/2$, 2π) (spherical – coordinates). **(07 Marks)**

2 a. Obtain the boundary conditions between two perfect dielectrics. **(07 Marks)**

b. An electrostatic field is given by $\vec{E} = -12xy\,\hat{a}_x - 6x^2\,\hat{a}_y + \hat{a}_z$ V/m . The charge of 6c is to be moved from B(1, 8, 5) to A(2, 18, 6). Find the work done in each of the following cases :
i) The path selected is $y = 3x^2 + z$; $z = x + 4$
ii) The straight line from B to A
Show that the work done remains same and is independent of the path selected. **(08 Marks)**

c. Find the work done in assembling four equal point charges of 2 μc each on x and y axis at ±3m and ±4m respectively. **(05 Marks)**

3 a. Obtain Poisson's and Laplace's equations form Maxwell's first equation. **(06 Marks)**

b. State and prove uniqueness theorem. **(08 Marks)**

c. Determine whether or not the following potential fields satisfy the Laplace's equation :
i) $V = x^2 - y^2 + z^2$
ii) $V = r\cos\phi + t$
iii) $V = r\cos\theta + \phi$. **(06 Marks)**

4 a. Obtain on expression for magnetic field intensity of a point due to infinite conductor using Biot – Savart's law.. **(08 Marks)**

b. State and prove Ampere's circuital law as applied to magnetic field. **(05 Marks)**

c. Evaluate both sides of the Stoke's theorem for the field $\vec{H} = 6xy\,\hat{a}_x - 3y^2\,\hat{a}_y$ A/m and the rectangular path around the region, $2 \le x \le 5$; $-1 \le y \le 1$; $z = 0$. Let the positive direction of $\vec{ds}$ be $\hat{a}_z$. **(07 Marks)**

PART – B

5 a. Discuss the magnetic boundary conditions to apply $\vec{B}$ and $\vec{H}$ at the interface between two different magnetic materials. **(06 Marks)**

b. Define self inductance. Derive an expression for self inductance of a co-axial cable. **(06 Marks)**

c. A rectangular loop in z = 0 plane has corners at (0, 0, 0), (1, 0, 0), (1, 2, 0) and (0, 2, 0). The loop carries a current of 5A in $\hat{a}_x$ direction. Find the total force produced by the magnetic field, $\vec{B} = 2\hat{a}_x + 2\hat{a}_y - 4\hat{a}_z \text{ Wh/mt}^2$. **(08 Marks)**

6 a. Explain the interpretation of Faraday's law applicable to time varying magnetic field and derive an expressions for 'transformer e.m.f' and motional e.m.f. **(06 Marks)**

b. Derive the equation giving relation between $\vec{A}$ and V (Lorent'z condition for potentials from retarded potentials) **(07 Marks)**

c. A parallel plate capacitor with plate area of 5cm^2 and plate separation of 3mm has a voltage of 50 sin (10^3t) volts applied to its plates. Calculate the displacement current assuming $\epsilon = 2\epsilon_0$. **(07 Marks)**

7 a. Obtain the solution of wave equations for uniform plane wave propagating in free space. **(10 Marks)**

b. Wet marshy soil is characterized by $\sigma = 10^{-2}$ s/m, $\epsilon_r = 15$ and $\mu_r = 1$. At frequencies 60Hz. 1mHz, 100mHz and 10 GHz. Indicate whether soil be considered as a conductor or a dielectric. **(10 Marks)**

8 a. With necessary expression, explain (SWR) standing wave ratio. **(10 Marks)**

b. Derive the expressions for transmission co-efficient and reflection co-efficient. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE45

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Power Electronics

Time: 3 hrs. Max. Marks:100

Note: 1. *Answer FIVE full questions, selecting at least TWO questions from each part.*
2. *Draw suitable sketches wherever necessary.*

PART – A

1 a. What is power electronics? Mention its industrial applications. **(05 Marks)**

b. With neat diagram and waveforms, explain control characteristics of (i) SCR and (ii) IGBT. **(08 Marks)**

c. Describe thyristorised tap changer with a neat schematic. **(07 Marks)**

2 a. Compare BJT, MOSFET and IGBT (any four points). **(04 Marks)**

b. For the circuit shown in Fig. Q2 (b) the details are given. The bipolar transistor is specified to have β_f in the range of 8 to 40. The load resistance is $R_c = 11\,\Omega$. The DC supply voltage is $V_{CC} = 200$ V and the input voltage to the base circuit is $V_B = 10$ V. If $V_{CE(sat)} = 1$ V and $V_{BE(sat)} = 1.5$ V find (i) the value of R_B that results in saturation with an ODF of 5, (ii) the β_{forced} and (iii) the power loss P_T in the transistor. **(10 Marks)**

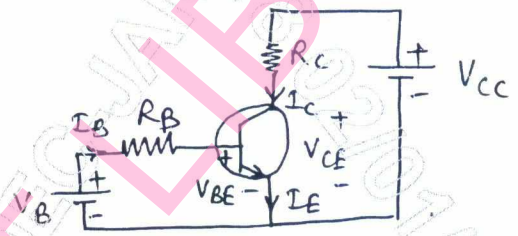

Fig. Q2 (b)

c. With a neat sketch describe the construction of IGBT. **(06 Marks)**

3 a. With the help of a two transistor model derive the expression for anode current for an SCR. **(10 Marks)**

b. Calculate the values of R, R_{B1} and R_{B2} for the following UJT trigger circuit. The parameters of UJT are $V_s = 30$V, $\eta = 0.51$, $I_p = 10\mu$A, $V_v = 3.5$ V and $I_v = 10$mA and $C = 0.5\mu$F. Assume $V_D = 0.5$ and frequency of oscillations f = 60 Hz, width of the triggering pulse $t_g = 50\,\mu$s. **(10 Marks)**

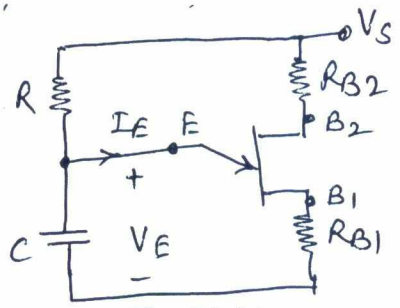

Fig. Q3 (b)

4 a. What do you mean by commutation in thyristors? Differentiate between natural and forced commutation. **(06 Marks)**

b. With the help of a schematic and waveforms explain complementary commutation. **(08 Marks)**

c. For the commutation circuit shown in Fig. Q4 (c) the DC source voltage is 120 V and the current through R_1 and R_2 = 20 A. The turn off time of both the SCRs is 60 μsec. Calculate the value of commutations capacitor C for successful commutation. **(06 Marks)**

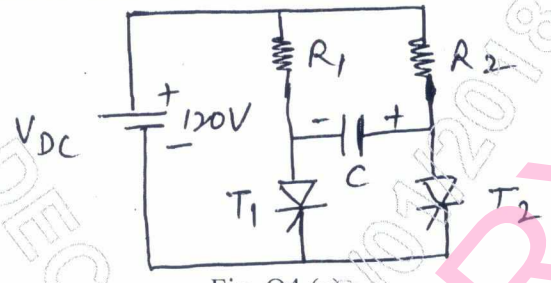

Fig. Q4 (c)

PART – B

5 a. With the help of a neat schematic and waveforms derive an expression for average output voltage of single phase semiconverter with RL load. **(10 Marks)**

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

6 a. What is chopper? What are the various types of chopper? **(06 Marks)**

b. With the help of a schematic and waveform explain step down chopper. **(08 Marks)**

c. A stepdown chopper has a resistive load of 10 Ω and the input voltage is 220 V. When the chopper switch remains on its voltage drop is V_{ch} = 2 V and the chopping frequency is 1 kHz. If the duty cycle is 50% determine (i) The average output voltage (ii) the rms output voltage and (iii) the chopper efficiency. **(06 Marks)**

7 a. Describe various performance parameters of inverter. **(06 Marks)**

b. What are the drawbacks of single phase half bridge inverter? Explain the operation of single phase full bridge inverter for resistive load. **(08 Marks)**

c. With relevant waveforms, explain the sinusoidal pulse width modulation in an inverter. **(06 Marks)**

8 a. Explain the principle of ON-OFF and phase control of AC voltage regulators. **(06 Marks)**

b. With the help of circuit diagram and waveforms explain the operation of single phase AC voltage bidirectional controller with R-L load. Derive an expression for output voltage. **(08 Marks)**

c. A single phase fullwave AC voltage controller has a resistive load of 10 Ω. Input voltage is 120 V (rms), 60 Hz. The delay angle of each thyristor is 90°. Find (i) rms output voltage and (ii) input power factor. **(06 Marks)**

* * * * *

USN | | | | | | | | | | |

10EE46

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
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. Explain the transformer action on no load and on load conditions. Draw the necessary vector diagrams. **(06 Marks)**

b. Distinguish between :
i) Power transformer and distribution transformer
ii) Current transformer and voltage transformer. **(06 Marks)**

c. A 2200/220V , 50Hz, single phase transformer has exciting current of 0.6A and a core loss of 361W, when its H.V side is energized at rated voltage. Calculate the two components of the exciting current (b) If the transformer of part (a) supplies a load current of 60A at 0.8pf lag on its I.V side, then calculate the primary current and its power factor. **(08 Marks)**

2 a. Derive the condition for maximum efficiency of a single phase transformer. **(04 Marks)**

b. Describe the test on a single phase transformer that gives ohmic losses and core losses. **(08 Marks)**

c. The following results were obtained on a 50KVA, 2400/120V transformer.
O.C. Test 396W, 9.65A, 120V – I.V. side
S.C. Test 810W, 20.8A, 92V – H.V. side
Determine :
i) the circuit constants
ii) the efficiency at full load, 0.8pf lag
iii) approximate voltage regulation
iv) draw the equivalent circuit referred to the secondary side. **(08 Marks)**

3 a. Why parallel operation of two transformers is necessary. **(04 Marks)**

b. Deduce the expression for the load shared by two transformers in parallel when the no load voltages are equal. **(08 Marks)**

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

4 a. Write a note on auto transformer. **(06 Marks)**

b. What is an open delta system? What are the applications of this system? **(06 Marks)**

c. A 3-phase transformer is used to step down the voltage of a 3 - ϕ, 11KV feeder line. Per phase turns ratio is 12. For a primary line current of 20A, calculate the secondary line current, voltage and output KVA for the following connections : i) star delta ii) delta – delta iii) delta – star iv) star star. **(08 Marks)**

PART – B

5 a. Differentiate between slip ring and squirrel cage induction motor. Mention two applications for each. **(06 Marks)**

b. Derive the relationship for torque developed by a 3-phase induction motor. Draw a typical torque slip characteristic and deduce the condition for maximum torque. **(08 Marks)**

c. A 3-phase, 4-pole 1440rpm, 50Hz, induction motor has star connected rotor winding, having a resistance of 0.2Ω per phase and a standstill leakage resistance of 1Ω per phase. When the stator is energized at rated voltage and frequency, the rotor induced any at standstill is 120V per phase. Calculate the rotor current rotor power factor and torque both at starting and at full load. **(06 Marks)**

6 a. Draw the induction motor phasor diagram at :
i) Standstill ii) at a full load slip S.
Draw the equivalent cc diagram of the induction motor. **(06 Marks)**

b. Explain the no load and blocked rotor test on a 3-phase induction motor. How are the parameters of equivalent circuit determined from the test results? **(06 Marks)**

c. The power input to a 6-pole, 3-phase, 50Hz induction motor is 42 KW, the speed is 970 rpm. The stator losses are 1.2KW and the friction and wind age losses are 1.8 KW. Find : i) slip ii) the rotor copper loss iii) the BHP iv) efficiency. **(08 Marks)**

7 a. Describe with sketches, the construction of a double cage induction motor and point out its advantages compared with a single cage motor. **(08 Marks)**

b. Why starters are necessary of starting induction motors? Name different starting methods for 3-phase induction motor. **(06 Marks)**

c. At standstill, the equivalent impedances/phase of the inner and outer cages of a double cage rotor as referred to stator are $(0.4 + j2)\Omega$ and $(2 + j4)\Omega$ respectively. Calculate the ratio of torques produced i) at standstill ii) at 5% slip. **(06 Marks)**

8 a. Write the speed equation of the 3-phase induction motor. Explain the method of speed control of 3-phase induction motor by varying the rotor resistance. **(06 Marks)**

b. Why single phase induction motor are not self starting. Explain different methods of starting the single phase induction motor. **(08 Marks)**

c. Write the note on circle diagram of an induction motor. **(06 Marks)**

* * * * *

USN | | | | | | | | | | |

MATDIP401

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Advanced Mathematics – II

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Find the direction cosines ℓ, m, n of the line :
$x + y + z + 1 = 0$
$4x + y - 2z + 2 = 0$. **(06 Marks)**

b. Show that the lines $\frac{x+4}{3} = \frac{y+6}{5} = \frac{z-1}{-2}$ and $3x - 2y + z + 5 = 0 = 2x + 3y + 4z - 4$ are coplanar. **(07 Marks)**

c. Find the angle between the line $\frac{x+4}{4} + \frac{y-3}{-3} = \frac{z+2}{1}$ and the plane $2x + 2y - z + 15 = 0$. **(07 Marks)**

2 a. Find the equation of the plane which passes through the points A(0, 1, 1), B(1, 1, 2), C(–1, 2, –2). **(06 Marks)**

b. Find the equation of the plane which passes through the point(3, –3, 1) and normal to the line joining the points (3, 2, –1) and (2, –1, 5). **(07 Marks)**

c. Find the equations to the two planes which bisects the angle between the planes :
$3x - 4y + 5z = 3$
$5x + 3y - 4z = 9$. **(07 Marks)**

3 a. Find the sides and the angle A of the triangle whose vertices are $\overline{OA} = I - 2J + 2K$, $\overline{OB} = 2I + J - K$, $\overline{OC} = 3I - J + 2K$. **(06 Marks)**

b. Show that the points $-6I + 3J + 2K$, $3I - 2J + 4K$, $5I + 7J + 3K$ and $-13I + 17J - k$ are coplanar. **(07 Marks)**

c. Prove that : $\left[\bar{B} \times \bar{C}, \bar{C} \times \bar{A}, \bar{A} \times \bar{B}\right] = \left[\bar{A}\,\bar{B}\,\bar{C}\right]^2$. **(07 Marks)**

4 a. A particle moves along the curve $x = t^2 + 1$, $y = t^2$, $z = 2t + 3 + \sin(\pi t)$ where t is the time. Find the velocity and acceleration at t = 1. **(06 Marks)**

b. If $\bar{A} = (\cos t)I + (\sin t)J + (4t)K$ and $\bar{B} = (t^3 + 1)I + J + (8t^2 - 3t^3)K$ then find :
i) $\frac{d}{dt}(\bar{A} + \bar{B})$ ii) $\frac{d}{dt}(\bar{A} \cdot \bar{B})$. **(07 Marks)**

c. If $\phi = 3x^2y - y^3z^2$, find grad ϕ at (1, –2, 1). Also find a unit normal vector to the surface $3x^2y - y^3z^2 = 6$ at (1, –2, 1). **(07 Marks)**

PART – B

5 a. If $\bar{A} = xyz\,I + 3x^2y\,J + (xz^2 - y^2z)K$ then find curl $\bar{A}$ at (1, 2, 3). **(06 Marks)**

b. Find the directional derivative of the scalar function $f(x, y, z) = x^2 + xy + z^2$ at the point A(1, –1, –1) in the direction of $2\hat{i} + 3\hat{j} + 2\hat{k}$. **(07 Marks)**

c. If $u = x^2 + y^2 + z^2$ and $\bar{r} = xI + yJ + zK$ then find div $(u\bar{r})$ in terms of u. if $\vec{f} = \nabla(x^3 + y^3 + 2^3 - 3xyz)$ find $\nabla \cdot \vec{f}$ and $\nabla \times \vec{f}$. **(07 Marks)**

6 a. Find the Laplace transform of f(t) defined as :

$$f(t) = \begin{cases} \frac{t}{6}, & \text{when } 0 < t < 6 \\ 1, & \text{when } t < 6 \end{cases}.$$ **(05 Marks)**

b. Find : i) $L(\cos^2 t)$ ii) $L(t \sin h\, at)$ iii) $L\left(\frac{1}{t}\sin 2t\right)$. **(15 Marks)**

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

b. Find : $L^{-1}\left(\frac{2h-5}{9s^2-25}\right)$. **(07 Marks)**

c. Find : $L^{-1}\left(\frac{s^2+4}{x^2+9}\right)$. **(07 Marks)**

8 a. Using Laplace transforms, find the solution of the initial value problem $y''-4y'+4y=64 \sin 2t$, $y(0) = 0$, $y'(0) = 1$. **(10 Marks)**

b. Using Laplace transforms, solve $y'' + 9y = \cos 2t$, $y(0) = 1$, $y'(0) = \frac{12}{5}$. **(10 Marks)**

* * * * *