



Knowledge Resource & Relay Centre (KRRC)

AIKTC/KRRC/SoET/ACKN/QUES/2022-23/

Date: 25/01/23

School: SoET-REV. C-SCHEME Branch: ELECT. ENGG. SEM: IV

To,
Exam Controller,
AIKTC, New Panvel.

Dear Sir/Madam,

Received with thanks the following **Semester/Unit Test-I/Unit Test-II (Reg./ATKT)** question papers from your exam cell:

Sr. No.	Subject Name	Subject Code	Format		No. of Copies
			SC	HC	
1	Engineering Mathematics-IV	EEC401		✓	
2	Electrical AC Machines-I	EEC402		✓	
3	Digital Electronics	EEC403		✓	
4	Power Electronic Devices and Circuits	EEC404		✓	
5	Electric and Hybrid Electric Vehicles	EEC405		✓	

Note: SC – Softcopy, HC - Hardcopy

(Shaheen Ansari)
Librarian, AIKTC

8/12/22

2:30 pm

Sem - IV - CBCS - KT

EE-R-19

Duration: 3 hours

Marks: 80

N.B. (1) Question No. 1 is **COMPULSORY**.(2) Answer **ANY THREE** questions from Q.2 to Q.6.

(3) Use of Statistical Tables permitted.

(4) Figures to right indicate full marks.

- Que. 1 a. Show that the following quadratic form $6x^2 + 3y^2 + 3z^2 - 4xy - 2yz + 4zx$ is positive definite 5
- b. Find the extremal of $\int_{x_1}^{x_2} \sqrt{1 + \left(\frac{dy}{dx}\right)^2} dx$ 5
- c. Find a unit vector orthogonal to the vectors $(1,1,1)$ and $(0,1,1)$. 5
- d. Evaluate $\int_0^{1+i} \bar{z} dz$ along the real axis from $z = 0$ to $z = 1$ then vertically to $1 + i$. 5

- Que. 2 a. Find the extremal of $\int_0^{\pi} (y'^2 - y^2 + 2xy) dy$ with $y(0) = 0$ 6
 $y\left(\frac{\pi}{2}\right) = 0$.
- b. In a normal distribution 30% of the items are below 35 and 10% of the items are above 60. Find the mean and standard deviation. 6
- c. The lines of regression are $20x - 9y - 107 = 0$ and $15x = 8y + 130$, $V(x) = 16$ Find the means, r , and $V(y)$. 8

- Que. 3 a. In sampling a large number of parts manufactured by a machine the mean number of defectives in a sample of 20 is 2. Out of 1000 such a sample how many would you expect to contain i) 3 defectives ii) less than 3 defectives. 6
- b. Find the line of regression of Y on X for the following data 6

X	5	6	7	8	9	10	11
Y	11	14	14	15	12	17	16

- c. Show that $V = \{(x,0) | x \text{ is real}\}$ with the operations of addition and scalar multiplication defined as $(x_1,0) + (x_2,0) = (x_1+x_2,0)$ and $k(x,0) = (kx,0)$ is a vector space. 8

- Que. 4 a. Reduce the following quadratic form $3x^2 + 5y^2 + 3z^2 - 2xy - 2yz + 2zx$ to canonical form also find rank signature and index. 6
- b. Verify Cauchy-Schwartz inequality for $U = (2, 4, -3, 5)$ and $V = (3, 2, 3, -1)$ 6
- c. Find all possible expansions of $f(z) = \frac{7z-2}{z(z-2)(z+1)}$ about $z = -1$ 8

- Que. 5 a. If the probability mass function of a random variable is $f(x) = kx(1-x)$, $0 \leq x \leq 1$. find its mean and variance. 6
- b. Find the orthonormal basis by Gram-Schmidt process to $(-1, 1, 0)$, $(0, 1, 1)$, $(1, 0, 1)$. 6
- c. Fit a second-degree parabolic curve to the following data 8

X	1	2	3	4	5	6	7	8	9
Y	2	6	7	8	10	11	11	10	9

- Que. 6 a. Show that $\{(a, 0, 0) \text{ such that } a \text{ is real}\}$ is subspace of \mathbb{R}^3 6
- b. Evaluate $\oint_C \frac{(z-3)}{z^2 + 2z + 5} dz$ where C is the circle (a) $|z|=1$ 6
 (b) $|z+1-i|=2$ (c) $|z+1+i|=2$
- c. Use Rayleigh-Ritz Method to find the extremal of $\int_0^1 (xy + \frac{1}{2}y'^2) dx$ given $y(0)=1$ & $y(1)=0$ 8

Sem - IV - CBCS - KT

(3 Hours)

Total Marks: 80

N.B: (1) Question No. 1 is compulsory.**(2) Attempt any three from the remaining questions.****(3) Figures to the right indicate full marks.****(4) Each question is of 20 Marks.****Q1. Answer ANY FOUR.**

- a) List down the conditions to be fulfilled for successful parallel operation of transformers. 05
- b) Explain torque speed characteristics of an induction motor. 05
- c) Whether a single phase induction motor is self-starting, justify your answer. 05
- d) With neat diagrams explain Dd6 and Dy1 connections. 05
- e) Derive relation between starting torque and full load torque for three phase Induction motor. 05

Q 2

- a) Two three phase transformers connected in parallel supply a load requiring an active power of 700 kW and lagging reactive power of 715 kVAR. Transformer 1 is rated at 400 KVA and has p.u. impedance of $(0.03 + j0.08)$ while transformer 2 is rated at 600 KVA and has p.u. impedance of $(0.02 + j0.07)$. Determine active power shared by each transformer and operating power factor. 10
- b) Write a short note on 'Saving of Copper in an Auto-transformer'. 10

Q 3

- a) Explain various power stages in an induction motor with necessary expressions. 10
- b) A 3 phase; 4 pole; 1440 rpm; 50 Hz induction motor has a star connected rotor with per phase rotor resistance and standstill reactance as 0.2Ω and 1Ω respectively. When the stator is energised with rated supply voltage at rated frequency the rotor induced e.m.f. between lines is 210V. Calculate, rotor current; power factor and torque at standstill and at full load. 10

Q 4

- a) Write a short note on 'Open Delta' connection of three phase transformer. 10
- c) An 8 pole 50 Hz, three phase induction motor runs at a speed of 720 rpm when delivering full load torque. Its rotor resistance and stand still reactance are 0.1Ω and 0.6Ω per phase respectively. An additional resistance of 0.5Ω per phase is inserted in the rotor circuit to control the speed. Calculate the speed at which the motor will run now if full load torque remains same. 10

Q 5

- a) A 220 V, 4 pole, 50 Hz split phase induction motor has following test results: 10

Blocked rotor test:	120 V	9.6 Amp.	460 Watts
No load test:	220 V	4.6 Amp.	125 Watts

The stator winding resistance is 1.5Ω and during the blocked rotor test, the starting winding is open. Determine the equivalent circuit parameters. Also find core, friction and windage losses.

- b) Explain i) capacitor start & capacitor run and ii) shaded pole induction motor with neat diagrams. 10

Q 6 Write short note on ANY TWO of the following.

- a) Deep bar and double cage induction motor. 10
 b) Oscillating neutral phenomenon in transformer. 10
 c) Scott connection. 10

Sem-IV - Re. KT

EE

EE

Duration: 3hrs

Total Marks: 80

- Note:**
1. Q. no. 1 is compulsory
 2. Solve any three questions from the rest
 3. Make suitable assumptions wherever applicable

Q. no. 1. Answer any four**(20)**

- a. Draw the diagram of a three input AND gate and write the truth table and logic expression.
- b. Convert $(247)_{10}$ in to octal and Hex equivalent.
- c. Explain what DCTL logic family is?
- d. Realize a half adder logic circuit using gates.
- e. What is a latch? Explain.

Q. No. 2.

- a. Perform the following subtraction using 2's complement method.

(10)

- i. $01000-01001$
- ii. $01100-00011$

- b. Write short note on characteristics of digital IC.

(10)**Q.No.3**

- a. Explain the TTL logic with the help of TTL NAND gate realization.

(10)

- b. Minimize the four variable logic function using K map

(10)

$$f(A,B,C,D)=AB\bar{C}D + \bar{A}BCD + \bar{A}\bar{B}\bar{C} + \bar{A}\bar{B}D + A\bar{C} + A\bar{B}C + \bar{B}$$

Q. No. 4.

- a. Minimize the following logic function and realize using NAND and NOR gate

(10)

$$f(A,B,C)=\sum m(0,1,4,6,8)$$

- b. Design a 6 bits binary to BCD converter using multiplexer.

(10)**Q. No. 5**

- a. Write short note on J-K master slave Flip flop.

(10)

- b. Design a three bits asynchronous binary counter using flip flop.

(10)**Q. No. 6****(20)**Write short not on **any 2**

- i. A 3 bit R-2R D/A converter
- ii. Dual slope A/D converter
- iii. Classification of memory

30 pm

EE (R-19)
Sem-IV - CBCS - KT

16/12/22

Time: 3 Hours

Max. Marks: 80

- Q1. Solve any 05** **4 marks each**
- Show the turn-on process of SCR using waveform and explain in short.
 - What are the advantages of using PWM rectifier?
 - How the silicon-carbide devices are different than normal silicone devices?
 - Compare VSI and CSI
 - Where the DC-DC converters are used.
 - How Snubber circuit protects semiconductor switches
 - How heat sink is selected?
- Q2. Solve any two out of three** **10 marks each**
- Why the gate driver circuit is required? Draw a Bootstrap and isolated gate driver (block diagram or circuit diagram)
 - Explain working of buck-boost converter. Draw waveforms and derive equation to calculate output voltage
 - Compare single phase half bridge inverter and full bridge inverter (any five points)
- Q3. Solve any Two out of Three** **10 marks each**
- Defined different performance parameters of single-phase bridge inverter.
 - Explain gate triggering techniques of SCR.
 - Describe the working of three phase bridge Inverter for 180° conduction mode and draw the gating signals and phase voltages.
- Q4. Solve any Two out of Three** **10 marks each**
- Draw the circuit diagram for a Boost dc to dc converter. Explain the functioning and draw the following waveforms (i) Inductor voltage; (ii) Inductor current; (iii) Capacitor current; (iv) Capacitor voltage and (v) Switch current.
 - Explain any two voltage commutation techniques for SCR.
 - Explain different PWM techniques with appropriate waveforms.
- Q5. Solve any Two out of Three** **10 marks each**
- Draw waveforms and explain single phase controlled rectifier diving R-L load with and without freewheeling diode.
 - Explain working of SCR and V-I characteristics of it.
 - Explain different PWM techniques with appropriate waveforms.
- Q6. Solve any Two out of Three** **10 marks each**
- Compare power BJT, MOSFT and IGBT
 - Explain working of SCR and V-I characteristics of it.
 - Explain Turn-ON techniques of SCR.

90M

EE (R-19)

19/12/22

Time: 3 Hrs

Sam - IV - CBCS - KT

Marks: 80

Note :

- Question No.1 is compulsory.
- Solve ANY THREE questions from the remaining five questions.
- Figure to the right indicates full marks.
- Assume suitable data wherever required, but justify the same.

		Marks
Q. 1	Attempt any four from the following. (Each 5 marks)	20
	a) Compare the characteristics and performance of different energy sources for EV application.	
	b) <i>What is the need and importance of electric vehicle?</i>	
	c) <i>Describe the concept of "Hybridness" and classify the HEV based on hybridness.</i>	
	d) State and explain the vehicle to grid and grid to vehicle operation in electric vehicle technology	
	e) Explain the performance parameter of the motors used in Electric vehicle	
Q2	a) Illustrate the historical background of EV / HEVs technology in brief. Also describe the current scenario of EV technology along with technology challenges associated it. (10)	(10)
	b) Describe the power flow scenario in a Parallel Hybrid and Series-Parallel Hybrid electric drive-train topologies. Also explain different modes of operation for both types of HEV (10)	(10)
Q.3	a) Draw and explain the ideal traction energy source (power plant) characteristic used in EV/HEVs. (6)	(6)
	State and define the key battery parameters (i) Battery capacity (ii) C rate (iii) SoC (iv) DoD (v) Specific Energy (vi) Energy Density. (6)	(6)
	b) What are the different battery charging modalities adopted for EV? (8)	(8)
	c) Explain each one in brief and also elaborate on standards adopted for the same worldwide. (8)	(8)
Q4.	Enlist the different architectures of hybrid electric drive train and explain the series-hybrid electric drive train. (10)	(10)
	a) Describe in detail all modes of operation for series-parallel hybrid vehicle. (10)	(10)
	b) Describe the design parameters of the ICE and motors in series hybrid drive. (10)	(10)
Q5.	a) Compare and differentiate between the battery electric vehicle (BEV), hybrid electric vehicle (HEV), and plug in HEV (PHEV) technologies. (10)	(10)
	b) Explain the two quadrant operation of chopper dc motor drive with suitable waveforms for electric vehicle. (10)	(10)
Q6.	a) Explain fuel cell and flywheel as energy source element in electrical and hybrid electric vehicle. (10)	(10)
	b) Explain fuel cell and flywheel as energy source element in electrical and hybrid electric vehicle. (10)	(10)

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11700834 - S.E.(Electrical Engineering)(SEM-IV)(Choice Base Credit Grading System) (R- 19) ('C' Scheme) / 40624 - Power Electronic Devices & Circuits

Correction in Q.P.Code: 15970

Replace Q.5C as Write short notes on protection of SCR.

Replace Q.6B as Draw and explain single phase Dual Converter.

2022-12-16 16:16:21 (sagardadmin)

~~Dr. Vinod Kumar~~
Vinod Kumar
(S)