KALSEKAR TECHNICAL CAMPUS

School of Architecture

School of Engineering & Technology

School of Pharmacy

Knowledge Resource & Relay Centre (KRRC)

AIKTC/KRRC/SoET/ACKN/QUES/2023-24/ **Date:** 10/07/24

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 Momin)
Librarian, AIKTC

Max. Marks: 80 EE - R19 - Sem IV **Time: 3 hrs.** 2:30 pm - 5:30pm

N.B. : 1. Q1 is compulsory
2. Attempt any three questions from Q2 to Q6.
3. Figures to the right indicate full marks.

Q1. (a) A r.v. X assumes the values $-3,-2,-1,0,1,2,3$ such that $P(X=1)=P(X>1)=P(X\le 0)$ and $2P(X=-3)=P(X=-2)=5P(X=-1)$, $P(X=1)=3P(X=2)=2P(X=3)$. Find the pmf and the distribution of X. 5

(b) The following calculations have been made for closing prices of 12 stocks (x) on the Mumbai stock exchange on a certain day, along with the volume of sales in thousands of shares (y). 5

$\sum x=580$, $\sum y=370$, $\sum x^2=41658$, $\sum xy=11494$, $\sum y^2=17205$

From these calculations, find the linear regression equation of volume of sales depending on stock price.

(c) Evaluate the integral $\int_C \frac{z-1}{z^2+3z+2}\,dz$, $C:|z|=\frac{3}{2}$. 5

(d) Convert the given set of vectors into an orthonormal basis using Gram Schmidt process of orthogonalization. $(2,-1,1)$, $(1,-1,3)$, $(1,1,2)$. 5

Q2. (a) Is the following a subspace of a given vector space with usual addition and scalar multiplication? Justify your answer. 6

(i) $W=\{(x,y,z)\mid x,y,z\in\mathbb{R}, y=x+z\}$

(ii) $W=\left\{\begin{bmatrix} a & b \\ c & d\end{bmatrix} \middle| \, a,b,c,d\in\mathbb{R}, \begin{vmatrix} a & b \\ c & d\end{vmatrix}\neq 0\right\}$

(b) A random variable X has the probability density function $f(x)=k\,x\left(9-x^2\right)$, $0\le x\le 3$. Find k and mean of X. 6

(c) Fit the least square line to the following data i) line of y on x ii) line of x on y. Also find the correlation coefficient using the regression coefficients. 8

x:	65	63	67	64	68	62	70
y:	68	66	68	65	69	66	68

Q3. (a) At a certain university, 4% of men are over 6 feet tall and 1% of women are over 6 feet tall. The total student population is divided in the ratio 3:2 in favour of women. If a student is selected at random from among all those over six feet tall, what is the probability that the student is a (i) woman (ii) man? 6

(b) Find the extremals of $\int_{x_1}^{x_2} \frac{(y')^2}{x^2}\,dx$. 6

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(c) Find a singular value decomposition of the matrix $\begin{bmatrix} 1 & 1 \\ 1 & -1 \\ 1 & -1 \end{bmatrix}$. 8

Q4. (a) Find the usual inner product of the two vectors $(-4,6,-1,1)$, $(2,1,-2,9)$. Find the norm of each vectors. Are these vectors orthogonal to each other? Verify the triangle inequality and Cauchy Schwarz inequality. 6

(b) Evaluate the following integrals using Cauchy Residue theorem. 6

$$\int_C \frac{1}{z^5} e^{z^2} \, dz \quad , \quad |z| = 1.$$

(c) The marks of 1000 students in a semester examination of an Engineering college are distributed normally with mean 70% and standard deviation 5%. Estimate the number of students whose marks will be i) between 60% and 75% ii) more than 75% iii) less than 68%. 8

Q5. (a) Find all possible Laurent's series expansion of $\dfrac{2z+1}{z^2+5z+6}$ about the origin. 6

(b) Find the extremals of $\int_0^1 xy + y^2 - 2y^2 y' \, dx$. 6

(c) Reduce the quadratic form $x_1^2 - 2x_2^2 + 3x_3^2 + 6x_1x_3 - 4x_2x_3$ to a diagonal form using a congruent transformation. Obtain the congruent transformation applied for the reduction. Find the rank, index signature and class value of the quadratic form. 8

Q6. (a) An examination of 11 applicant for an accountant post was taken by a finance company. The marks obtained by the candidate in reasoning (x) and aptitude (y) test are given below. Calculate the rank correlation coefficient between the performance in the reasoning and aptitude test. 6

x :	20	50	25	70	90	50	76	45	30	19	26
y :	30	60	40	50	45	30	68	30	47	39	38

(b) Evaluate using Cauchy integral formula, 6

$$\int_C \frac{2z^3 + z^2 + 4}{z^4 + 4z^2} \, dz \quad , \; C : |z - 2 - 2i| = 3.$$

(c) Using Rayleigh-Ritz method, find an approximate solution for the extremal of 8

$$\int_0^1 2xy - y^2 - (y')^2 \, dx, \; y(0) = 0, \; y(1) = 0.$$

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16.05.2024

EE- R19 - Sem IV

2:30pm - 5:30pm

(03 Hours) **Total marks:80**

N.B.:- (1) Question No.**1** is compulsory.
(2) **Attempt** any **three** questions out of remaining **five** questions.
(3) Assume suitable data if necessary and justify the same.

Q.1 Solve **any four**

a. Explain various losses taking place in a single-phase transformer **05M**
b. List out the advantages, Disadvantages and applications of autotransformer **05M**
c. Explain connection and phasor diagram of yy0 transformer **05M**
d. Explain the applications of single-phase induction motor. **05M**
e. Describe torque-speed characteristics of a three phase IM in braking, motoring and generating regions. **05M**

Q.2. Answer the following questions.

a. Explain the need of starter in three phase IM. Describe Direct On Line (DOL) starter in Detail. **10M**
b. Explain the power stages with neat labeled diagram and expression in three phase IM. **10M**

Q. 3 Answer the following questions.

a. Explain saving of cu in auto transformer. **10M**
b. Describe the V - connection with diagram. **10M**

Q.4. Answer the following questions.

a. Explain construction, working of capacitor start Single phase Induction Motor. **10M**

b An 18.64 KW, 4 pole 50 Hz 3-phase induction motor has friction and windage losses of 2.5% of output. The full load slip is 4%. Find for full load (i) rotor Cu loss (ii) the rotor input (iii) the shaft torque. (iv) the gross electromagnetic torque.

Q.5. Answer the following questions

a. Discuss the necessary conditions required for parallel operation of three phase transformers, **10M**

b. A 200 kVA, 2000/440 V, 50 Hz single-phase transformer gave the following test results. **10M**
O.C. test: 2000 V, 1.8 A, 175 kW ..... on H.V. side
S.C. test: 13 V, 300 A, 1kw..... on L.V. side
Obtain the equivalent circuit parameters as referred to H.V. side.

Q.6. Answer the following questions

a. Explain Double field revolving theory in single phase Induction motor. **10M**

b. What is the Oscillating neutral phenomenon in three phase transformers. **10M**

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EE - R19 - Sem IV 2:30pm - 5:30pm

Duration: 3hrs **Total Marks:80**

N.B.: (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

1		Attempt **any FOUR**	**[20]**
	a	Convert $(1110010.1010)_2=(?)_{16}(?)_8 \quad (?)_{10}(?)_{gray} \quad (?)_{xs\text{-}3code}$	**[5]**
	b	Implement 8:1 Mux with 4:1 Mux	**[5]**
	c	What is latch? How a latch is different from flip flop?	**[5]**
	d	Compare SRAM and DRAM	**[5]**
	e	Compare PLA and PAL	**[5]**
2	a	$F(p,q,r,s)=\sum m(0,2,5,6,8,9,11,13)+d(3,7,15)$ solve using K-map	**[10]**
	b	Explain the sample and hold circuit.	**[10]**
3	a	Explain the MasterSlave JK flipflop.	**[10]**
	b	Explain the classification and characteristics of memory.	**[10]**
4	a	Design the 4 bit Asynchronous counter.	**[10]**
	b	Implement 3 bit binary to gray converter using NAND gate	**[10]**
5	a	What is universal shift register ? Draw the circuit and explain its working.	**[10]**
	b	Explain the 3 bit R-2R D/A converter	**[10]**
6	a	Implement the T to D flip flop and JK to SR	**[10]**
	b	Short on **any two**:	**[10]**
		i) Dual slop A to D converter	
		ii) FPGA	
		iii) Shift Register	

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24.5.2024

EE - R19 - SEM IV

2:30pm - 5:30pm

Total Marks: 80 **Duration: 3 Hrs.**

N.B.: - (1) Question No.1 is compulsory.
(2) Attempt any three questions from Q2. to Q6.
(3) Assume suitable data if necessary and justify the same.
(4) Figures to right indicate full marks

Q.1 Answer **ANY FOUR** questions.

a) Discuss the significance of di/dt and dv/dt in SCRs [5]

b) Explain the p-n layered structure of power diode and draw the VI characteristics for power and signal diode. [5]

c) Compare single phase half wave controlled and uncontrolled rectifiers with R-load. [5]

d) What is Pulse Width Modulation? Explain any PWM technique in brief. [5]

e) Write a note on Snubber Circuit. [5]

Q.2 a) Describe R and RC firing circuits of SCR. [10]

b) Explain 180 degrees conduction mode of 3 phase Inverter with appropriate waveforms and Voltage equations. [10]

Q.3 a) Explain the operation of Power IGBT and its Turn ON and Turn OFF characteristics. [10]

b) Explain the role of heat sinks in Power Electronics. [10]

Q.4 a) Draw and explain the operation of a fully controlled bridge rectifier with RL load and derive the expression for average and RMS values of DC output voltage. [10]

b) Explain the control of Output Voltage of Buck Boost Regulator by controlling the Duty Cycle. [10]

Q.5 a) What is the commutation process in SCR? give its different types and explain Complementary and natural commutation in detail [10]

b) A step up chopper has an input voltage of 220 V and output voltage of 660 V. If the conduction time of Thyristor chopper is 100 microsec, compute the pulse width of output voltage. [10]
Also find the average value of output voltage if the output voltage pulse width is halved for constant frequency operation.

Q.6 a) Explain 3-phase half wave controlled rectifier with R load with the necessary diagrams for continuous mode of conduction. Derive the expression for output voltage. [10]

b) Explain SOA of Power Transistors. [5]

c) Draw and explain half bridge Voltage Source Inverter with R load. Draw the output voltage and current waveforms. [5]

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28/05/2024

EE_R19_SEM IV

2.30 PM -5.30 PM

Time: 3 Hours **Marks: 80**

Note :

- **Question No.1 is compulsory.**
- Solve **ANY THREE** questions from the **remaining** questions.
- Figure to the right indicates full marks.

			Marks
Q. 1		Solve **ANY FOUR** questions from following. (Each question carries 5 marks)	**20**
	a)	Explain the basic movements in vehicle driving.	
	b)	Explain the AC and DC characteristics of motors used in EV/HEV.	
	c)	Give the importance of ulteracapacitors in EV/ HEV	
	d)	Explain the AC and DC chargers used for EV/HEV.	
	e)	Calculate the capacity of a battery drawing 42 Ah current at 10 hr time rate. the Peukert coefficient is 1.107.	
Q. 2	**a)**	Explain the series architecture with neat diagram. Also explain the power flow stages.	**10**
	b)	Explain why hybridization of energy sources is important for EV/HEV.	**10**
Q.3	**a)**	Explain the power characteristics of ICE?	**10**
	b)	Explain the working of Fuel cell with neat diagram.	**10**
Q4.	**a)**	Derive the expression of power output for the series motor?	**10**
	b)	Explain with neat diagram V2G concept? Also mention the advantages and disadvantages.	**10**
Q5.	**a)**	Classify Energy Management Strategies. Explain Rule based energy management strategies.	**10**
	b)	Explain the working of SRM motor used in EV/HEV.	**10**
Q6.	**a)**	Compare the fuel efficiency of series and parallel drive.	**10**
	b)	Explain working of converters. Draw and explain two quadrant DC-DC choppers.	**10**

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