

**SEMIV Examinations May 2022**  
Curriculum Scheme: Rev-2019 'C' Scheme

Course Code: **EEC401**  
Time: 3 hour

Course Name: **Engineering Mathematics IV**  
Max. Marks: 80

Note: Q1, Q2, Q3 and Q4 are carrying 20 equal marks.

Q1.	<b>Choose the correct option for following questions. All the Questions are compulsory and carry equal marks</b>
<b>2 marks each</b>	
1.	If x is normally distributed with mean 10 and standard deviation 2, find p ( $8 \leq x \leq 10$ )
Option A:	0.1113
Option B:	0.3413
Option C:	0.0413
Option D:	0.1013
2.	Find extremals of $\int_{x_1}^{x_2} (y'^2 - y^2 + 2xy) dx$
Option A:	$c_1 \cos x + c_2 \sin x + x$
Option B:	$c_1 x \cos x + c_2 x \sin x$
Option C:	$c_1 \cos x + c_2 \sin x + x^2$
Option D:	$c_1 \cos hx + c_2 \sin hx + x$
3.	Find value of k if U = (2, 1, 3) and V = (4, 7, k) are orthogonal.
Option A:	K = -4
Option B:	K = 4
Option C:	K = 5
Option D:	K = -5
4.	Evaluate $\int_C \frac{2x+3}{(x+2)(x-3)}$ Where C is circle $ z  = 3$ .
Option A:	$\frac{3\pi i}{5}$
Option B:	$-\frac{3\pi i}{5}$
Option C:	$\frac{2\pi i}{5}$
Option D:	$-\frac{2\pi i}{5}$
5.	The equations of the two lines of regression are $5x - y = 22$ and $64x - 45y = 24$ . Find means for x and y.
Option A:	$x = 6, y = 8$
Option B:	$x = 3, y = 8$
Option C:	$x = 4, y = 8$
Option D:	$x = 6, y = 5$
6.	Given $f(z) = \frac{1}{2(z+1)} - \frac{1}{2(z+3)}$ for $1 <  z  < 3$ , the expansion of f(z) is

Option A:	$f(z) = \dots + \frac{1}{2z^3} - \frac{1}{2z^2} + \frac{1}{2z} - \frac{1}{6} + \frac{1}{18}z - \frac{1}{54}z^2 + \frac{1}{162}z^3 + \dots$
Option B:	$f(z) = \dots + \frac{1}{z^3} - \frac{1}{z^2} + \frac{1}{2z} + \frac{1}{6} - \frac{1}{18}z + \frac{1}{54}z^2 - \frac{1}{162}z^3 + \dots$
Option C:	$f(z) = \dots + \frac{1}{2z^3} + \frac{1}{2z^2} + \frac{1}{2z} + \frac{1}{6} + \frac{1}{18}z + \frac{1}{54}z^2 - \frac{1}{162}z^3 + \dots$
Option D:	$f(z) = \dots + \frac{1}{2z^3} - \frac{1}{2z^2} - \frac{1}{18}z + \frac{1}{54}z^2 - \frac{1}{162}z^3 + \dots$
7.	Find cosine of angle between the vectors $U = (1, 2, 3, -1)$ and $V = (2, 1, -2, 3)$
Option A:	$\frac{5}{\sqrt{270}}$
Option B:	$\frac{-4}{\sqrt{270}}$
Option C:	$\frac{-3}{\sqrt{270}}$
Option D:	$\frac{-5}{\sqrt{270}}$
8.	Given $N = 5, \sum d_i^2 = 8$ . Find the rank correlation coefficient R.
Option A:	$R = 0.6$
Option B:	$R = 0.5$
Option C:	$R = 0.4$
Option D:	$R = 0.3$
9.	Find Variance of Binomial distribution with $n = 8, p = \frac{1}{4}$
Option A:	1.1
Option B:	1.5
Option C:	1.2
Option D:	1.3
10.	Find the extremal of $\int_{x_1}^{x_2} \frac{y}{x^3} dx$
Option A:	$cx^2 = 1$
Option B:	$cx^3 = 1$
Option C:	$cx^3 = 2$
Option D:	$cx^3 = -2$



<b>Q2.</b> <b>(20 Marks)</b>	<b>Solve any Four out of Six.5 marks each</b>
A	Reduce the quadratic form $Q = 2x_1^2 + x_2^2 - 3x_3^2 - 8x_2x_3 - 4x_3x_1 + 12x_1x_2$ to normal form through linear transformation. Also find rank, index, signature and class value.
B	Construct orthonormal basis of $R^2$ by applying Gram-Schmidt process. Where $S = \{(3, 1), (4, 2)\}$ .
C	Evaluate $\int_C \frac{dz}{(z^2-4)(z+4)}$ Where C is circle $ z  = 4$ using Cauchy's Residue theorem
D	For normal distribution 30 % items are below 45 and 8 % items are above 64. Find mean and Standard deviation
E	Find extremals of $\int_{x_1}^{x_2} (y'^2 - y^2 + 2xy) dx$
F	The equation of two lines of regression for bivariate data are $9x+10y-67=0$ $5x+2y-23=0$ Find i) Means values for x&y ii) Regression coefficients iii) Correlation coefficient

<b>Q3.</b> <b>(20 Marks)</b>	<b>Solve any Four out of Six.5 marks each</b>																
A	Find extremals of $\int_0^1 (xy + y^2 - 2y^2y') dx$																
B	If $P(X=x) = \frac{x}{25}$ , $x=1,3,5,7,9$ Find $P(X=1 \text{ or } X=3)$ and $P(4 < X < 8)$																
C	Examine the following vectors are linearly independent if so find relation between them $(1,2,3,4), (0,1,0,-1), (1,3,3,3)$																
D	Find the residues at their poles for $f(z) = \frac{z}{(z+3)(z-1)^2}$																
E	Find angle between the vectors $U = (6, 2, 4)$ and $V = (2, 0, -3)$																
F	Calculate the coefficient of correlation between x&y from the data <table border="1" style="margin-left: 20px;"> <tr> <td>x</td> <td>51</td> <td>54</td> <td>56</td> <td>59</td> <td>65</td> <td>60</td> <td>70</td> </tr> <tr> <td>y</td> <td>38</td> <td>44</td> <td>33</td> <td>36</td> <td>33</td> <td>23</td> <td>13</td> </tr> </table>	x	51	54	56	59	65	60	70	y	38	44	33	36	33	23	13
x	51	54	56	59	65	60	70										
y	38	44	33	36	33	23	13										

<b>Q4.</b> <b>(20 Marks)</b>	<b>Solve any Four out of Six. 5 marks each</b>																		
A	Calculate rank correlation coefficient between marks of Test 1 and Test 2 <table border="1" style="margin-left: 20px;"> <tr> <td>Test1</td> <td>52</td> <td>63</td> <td>45</td> <td>36</td> <td>72</td> <td>65</td> <td>45</td> <td>25</td> </tr> <tr> <td>Test2</td> <td>52</td> <td>53</td> <td>51</td> <td>25</td> <td>79</td> <td>43</td> <td>60</td> <td>33</td> </tr> </table>	Test1	52	63	45	36	72	65	45	25	Test2	52	53	51	25	79	43	60	33
Test1	52	63	45	36	72	65	45	25											
Test2	52	53	51	25	79	43	60	33											
B	Evaluate $\int z^2 dz$ along the upper half of circle $ z  = 2$																		
C	Obtain the Laurent series for $f(z) = \frac{z}{(z-1)(z+3)}$ in $1 <  z  < 3$																		
D	Reduce the quadratic form $Q = 3x_1^2 + 3x_2^2 + 3x_3^2 - 2x_2x_3 + 2x_3x_1 + 2x_1x_2$ to normal form through linear transformation. Also find rank, index, signature and class value.																		
E	By Gram-Schmidt process, find orthogonal basis for $u_1 = (1,1,1)$ , $u_2 = (-1,1,0)$ , $u_3 = (1,2,1)$																		
F	Find extremals of $\int_0^\pi (y'^2 - y^2) dx$																		

Program: BE ELECTRICAL Engineering

Curriculum Scheme: Revised 2019 C

Examination: Second year Semester IV

Course Code: EEC402

Course Name: electrical AC machine 1

Time: 2 hour 30min

Max. Marks: 80

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Note to the students:- All the Questions are compulsory and carry equal marks .

Q1.	Which losses are recorded during open circuit in single phase transformer
Option A:	Core losses
Option B:	Copper losses
Option C:	Both a and b
Option D:	Friction and windage loss
Q2.	During short-circuit test, iron losses are negligible because
Option A:	the current on secondary side is negligible
Option B:	the voltage on secondary side does not vary
Option C:	the voltage applied on primary side is low
Option D:	full-load current is not supplied to the transformer.
Q3.	Which method is used for transferring power through auto transformer
Option A:	Induction
Option B:	conduction
Option C:	Mutual coupling
Option D:	Conduction & induction
Q4.	The delta connection has advantage of restricting the third harmonic current to
Option A:	Within star connection
Option B:	Within delta connection
Option C:	Within star and delta connection
Option D:	neither star or delta connection
Q5.	Which type of connection is used in 3 ph transformer for the substation end of transmission line.
Option A:	Sta-star
Option B:	Star- delta
Option C:	Delta-delta
Option D:	Delta-star
Q6.	In order to semi closed or totally closed slot are used in induction motor
Option A:	Improve power factor
Option B:	Improve efficiency
Option C:	Improve starting torque
Option D:	Improve pull out torque
Q7.	Induction generator deliver power at _____ power factor
Option A:	leading
Option B:	lagging

Option C:	unity
Option D:	zero
Q8.	In a variable speed induction motor drive $v/f$ is kept constant over its wide range of frequency the motor operate in following mode.
Option A:	Constant power mode
Option B:	Constant slip mode
Option C:	Constant torque mode
Option D:	variable power mode
Q9.	In a circle diagram of 3ph induction motor the rotor diameter is determine by
Option A:	Total stator current
Option B:	Rotor current
Option C:	Exciting current
Option D:	Rotor current ref to stator
Q10	In a split-phase motor, the running winding should have
Option A:	High resistance and low inductance
Option B:	High resistance and High inductance
Option C:	Low resistance and high inductance
Option D:	Low resistance and low inductance

Q2.	SOLVE ANY TWO	20 MARKS
1	Explain open circuit and short circuit test on 1 PH transformer how to determine different parameters from these test..	
2	Derive expression for copper saving in step down auto transformer.	
3	Explain with the the help of phasor diagram and connection diagram how Scott connection are used to obtain two phase supply from three phase supply mains.	
Q3.	SOLVE ANY TWO	20 MARKS
1	Explain construction and working of 3 ph induction motor with neat diagram.	
2	What is the need of starter in 3 ph induction motor explain star delta stater with neat diagram or auto transformer starter with neat diagram.	
3	Explain in detail shaded pole starting of 1 PH induction motor and its torque speed characteristic.	
Q4.	SOLVE ANY TWO	20 MARKS
1	Explain switching in transient phenomenon in 3 ph transformer.	
2	What are the parameter found from no load and blocked rotor test of three phase induction motor.	
3	What is the need of speed control 3 ph induction motor.list the method used.explain pole changing method in detail	

**University of Mumbai**  
**Examinations First Half 2022**  
 Program: **Electrical Engineering**  
 Curriculum Scheme: Rev2019  
 Examination: SE Semester IV  
 Course Code: EEC403 and Course Name: Digital Electronics

**Note: 1. Make any suitable assumption**

**2. Figure to the right indicates full marks**

**Max. Marks 80**

**Solve all.**

**Q1. Choose the correct option for following questions. All the Questions are compulsory and carry equal marks (20)**

- 1 The MSB of signed binary number indicates its
- Option A: parity
- Option B: Sign
- Option C: maximum number
- Option D: its always zero and does not indicate any thing
- 2 The number of similar gates which a gate can drive is known as
- Option A: output
- Option B: fan out
- Option C: drive capacity
- Option D: A gate does not drive another gate
- 3 What is the BCD code for  $(13)_{10}$ ?
- Option A: 00001101
- Option B: 00000111
- Option C: 00010011
- Option D: 00001011
- 4 Minimum number of selection inputs required for selecting one out of 32 inputs is
- 
- Option A: 4
- Option B: 3
- Option C: 5
- Option D: 8
5. A three variable expression with variables A, B, C is given as  $Y=AB+AC+ABC$ .



This expression is in which form?

- Option A: Canonical POS Form
- Option B: POS Form
- Option C: SOP Form
- Option D: Canonical SOP form

6. How many cells will be present in the K-map of  $f(A,B,C,D)=\pi M(2,4,6,7)$

- Option A: 4
- Option B: 8
- Option C: 12
- Option D: 16

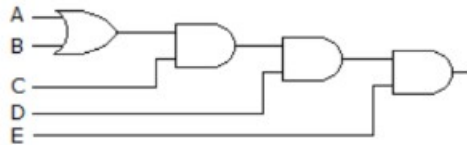
7. The complex programmable logic device contains several PLD blocks and

- Option A: Field-programmable switches
- Option B: AND/OR arrays
- Option C: A global interconnection matrix
- Option D: A language compiler

8. Which Flip Flop is used to overcome the Race-Around condition?

- Option A: D Flip Flop
- Option B: Master Slave J K Flip Flop
- Option C: S R Flip Flop
- Option D: T Flip Flop

9. Derive the Boolean expression for the logic circuit shown below



- Option A:  $ABCDE$
- Option B:  $[C(A + B)D + \bar{E}]$
- Option C:  $[[C(A + B)D]\bar{E}]$
- Option D:  $C(A + B)DE$

10. Which of the following is a combinational circuit?

- Option A: Multiplexer
- Option B: Registers
- Option C: Counters
- Option D: Latches

### Q.No. 2. Solve any Two

a. Convert the hex number A72E to equivalent binary, decimal, octal, BCD and Grey code

(10)

b. Design BCD to Excess 3 code converter using basic gates.

(10)

c. Simplify the following using K-map implement using NAND gates  
 $y = \sum m(0,1,2,5,9,13,14,15) + d(4,6,10)$

(10)

**Q.No. 3. Solve any Two**

- a. Design MOD 12 synchronous counter using T flip flop. (10)
- b. Explain the design of a 4 bits D to A converter using weighted register D/A technique. Use suitable diagrams for the explanation. (10)
- c. Write a note on Programmable Arrey Logic. Implement the following using PAL  
 $F(A,B,C,D) = \sum m(0,1,3,15)$  (10)

**Q.No. 4. Solve any Two**

- a.
  - i. Write a short note on memory mapping and address decoding.
  - ii. Write short notes on different logic families (TTL; CMOS). (10)
- b. What is quantization? Explain three bits A to D converter using successive approximation technique. Explain with the help of suitable diagrams (10)
- c. write short note on the characteristics of digital IC (10)



University of Mumbai  
**Examination First Half 2022**  
**Examinations Commencing from 17<sup>th</sup> May 2022 to 30<sup>th</sup> May 2022**  
 Program: Electrical  
 Curriculum Scheme: Rev 2019  
 Examination: SE Semester IV

Course Code: EEC404 Paper code: 40624 Course Name: Power Electronics Devices & Circuits  
 Time: 2 hour 30 minutes Max. Marks: 80

<b>Q1.</b>	<b>Choose the correct option for following questions. All the Questions are compulsory and carry equal marks</b>
1	The average output voltage of converter circuit, with increase in firing angle
Option A:	increases
Option B:	decreases
Option C:	remains constant
Option D:	becomes zero
2	Comparing triac and SCR
Option A:	Both are unidirectional device
Option B:	Triac require more current to turn on at particular voltage
Option C:	Both are bi directional device
Option D:	Triac requires less time to turn off
3.	Constant ripple free output current can be achieved in
Option A:	converters with R load
Option B:	Converters with RL load
Option C:	Inverters with R load
Option D:	Inverters with RL load
4	What is the duty cycle of a chopper ?
Option A:	Ton/Toff
Option B:	Ton/T
Option C:	T/Toñ
Option D:	Toff x Ton
5.	A four quadrant operation requires
Option A:	Two full converters in series
Option B:	Two full converters connected back to back
Option C:	Two full converters connected in parallel
Option D:	Two semiconverters connected back to back
6.	In a VSI (Voltage source inverter)
Option A:	the internal impedance of the DC source is negligible
Option B:	the internal impedance of the DC source is very very high
Option C:	the internal impedance of the AC source is negligible
Option D:	the IGBTs are fired at 0 degrees.
7.	To turn OFF an SCR, the anode current must be brought below -----

	current and a reverse voltage must be applied for a time larger than ----- - time of the device.
Option A:	holding, turn off
Option B:	holding, turn on
Option C:	latching, turn off
Option D:	latching, turn on
8	di/dt protection is provided to the SCR by .....
Option A:	connecting an inductor in parallel with SCR
Option B:	connecting an inductor in series with SCR
Option C:	connecting a capacitor in series with SCR
Option D:	connecting a capacitor in parallel with SCR
9	What is the formula for output voltage for Buck converter?
Option A:	$8D \times V_{in}$
Option B:	$5D \times V_{in}$
Option C:	$3D \times V_{in}$
Option D:	$D \times V_{in}$
10	Choose the wrong statement for an LED driver circuit.
Option A:	Regulates the current flowing through LED
Option B:	LED light output is proportional to its current
Option C:	Has an inbuilt rectifier if input is AC
Option D:	Decreases the lamp life of the LED

<b>Q2.</b> <b>(20 Marks)</b>	<b>Solve any Four out of Six</b>	<b>5 marks each</b>
A	Write a short note on protection of SCR.	
B	Discuss <b>Sinusoidal Pulse Width Modulation</b> technique	
C	A boost regulator has input voltage of 5volts. The average output voltage is 15volts. Load current is constant and equal to 0.5 Amp. The switching frequency is 25kHz. If L is 150 $\mu$ H and C= 220 $\mu$ F, find out:- Duty cycle and $\Delta I_L$	
D	What is a bootstrap driver circuit? Why it is needed?	
E	What do you mean by two transistor analogy of SCR? Derive relation and condition of anode current.	
F	Compare power MOSFET & IGBT (any five points).	

<b>Q3.</b> <b>(20 Marks)</b>	<b>Solve any Two Questions out of Three</b>	<b>10 marks each</b>
A	Explain gate triggering techniques for SCR.	
B	Explain Buck-boost regulator with circuit diagram and derive the relation for output voltage.	
C	Describe the working of dual converter with circuit diagram and waveforms	

<b>Q4</b> <b>(20 Marks)</b>	<b>Solve any Two Questions out of Three</b>	<b>10 marks each</b>
A	Explain the working of single phase full bridge converter with R-L load with circuit diagram and draw the supply and load voltage waveform for firing angle 90°.	
B	Describe the working of three phase bridge Inverter for 180° conduction mode and draw the gating signals and phase voltages.	
C	What is forced commutation? Explain any two commutation techniques with circuit diagram.	



**University of Mumbai**  
**Examinations Summer 2022**

Time: 2 hour 30 minutes

Max. Marks: 80

<b>Q1.</b>	<b>Choose the correct option for following questions. All the Questions are compulsory and carry equal marks – 2 marks each</b>
1.	Which of the following is NOT a Hybrid Vehicle?
Option A:	Plug-in hybrid
Option B:	Parallel hybrid
Option C:	Series hybrid
Option D:	ICE vehicle
2.	..... is associated with the force necessary to overcome the friction of EV tires.
Option A:	Gravitational resistance
Option B:	Aerodynamics resistance
Option C:	Friction resistance
Option D:	Rolling resistance
3.	Electrical Vehicle are generally power by
Option A:	Aluminum battery
Option B:	Lithium Ion Battery
Option C:	Sodium battery
Option D:	Magnesium battery
4.	An EV only needs one of the following maintenance jobs done. Which is it?
Option A:	Oil change
Option B:	Belt replacement
Option C:	New spark plugs
Option D:	Brake pad inspections
5.	When was the first electric car invented?
Option A:	1851
Option B:	1831
Option C:	1832
Option D:	1932
6.	The Field Oriented Control (FOC) enables the induction machine being controlled alike the
Option A:	separately excited DC Machine
Option B:	Permanent magnet DC machine
Option C:	Switched reluctance machine
Option D:	Stepper motor
7.	..... hybrid vehicle is either propelled by ICE or battery
Option A:	Parallel
Option B:	Series
Option C:	Split
Option D:	Mild
8.	For Hybridness H=100% the vehicle is a pure _____ Vehicle
Option A:	Electrical
Option B:	Mechanical
Option C:	Gasoline
Option D:	Hybrid

9.	Energy management unit cooperates with ..... to control regenerative braking and its energy recovery.
Option A:	Energy refueling unit
Option B:	Electric motor
Option C:	Mechanical transmission
Option D:	Electronic controller
10.	Which strategy is more efficient for ICE engine fuel economy calculation and emission in energy management strategy system?
Option A:	Optimization based system
Option B:	Rule based energy management system
Option C:	Global optimization strategy
Option D:	Fuzzy rule-based energy management system

<b>Q2</b>	<b>Solve any Four out of Six</b>	<b>5 marks each</b>
A	What is the need and importance of electric vehicle?	
B	What are the requirement of energy supplies and energy storages in electric and hybrid electric vehicle?	
C	Explain the characteristics and performance of ultra-capacitor for EV application.	
D	State and explain the vehicle to grid and grid to vehicle operation in electric vehicle technology	
E	Explain briefly the performance parameter of the vehicle.	
F	Comment on the suitability of DC and AC machine for electric and hybrid electric vehicle application.	

<b>Q3</b>	<b>Solve any Two Questions out of Three</b>	<b>10 marks each</b>
A	Explain fuel cell and flywheel as energy source elements in electric and hybrid electric vehicles	
B	State historical background of EV / HEV technology in brief. Describe the current state of the art of EV / HEV technology along with technology challenges associated with it	
C	Compare and differentiate between the battery electric vehicle (BEV), hybrid electric vehicle (HEV), and plug in HEV (PHEV) technologies.	

<b>Q4.</b>		
A	<b>Solve any Two</b>	<b>5 marks each</b>
i.	Draw the schematic of general configuration of electrical subsystem of an Electric Vehicle (EV) and a Hybrid Electric Vehicle (HEV).	
ii.	State and define the key battery parameters (i) Battery capacity (ii) C rate (iii) SoC (iv) DoD (v) Specific Energy (vi) Energy Density.	
iii.	Describe the concept of "Hybridness" and classify the HEV based on hybridness.	
B	<b>Solve any One</b>	<b>10 marks each</b>
i.	Describe in detail all modes of operation of a series hybrid vehicle	
ii.	Explain the terms rolling resistance and aerodynamic drag in vehicles and derive the expression for vehicle translational speed from fundamentals	