F 3621 (Pages : 4) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Common to all Branches except C.S. and I.T.

EN 010 501-A—ENGINEERING MATHEMATICS—IV

(Regular/Improvement/Supplementary)

[New Scheme—2010 Admission onwards]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 3 *marks.*

1. An electrostatic field in the xy-plane is given by the potential function $\phi = 3x^2y - y^3$, find the stream function.

2. Find the image of the circle $|z-1|=1$ in the complex plane under the mapping $w=\frac{1}{z}$.

3. Find the real root of the equation $x^2 - 2x - 5 = 0$ by the method of false position correct to 3 decimal places.

4. Solve $\frac{dy}{dx} = 1 - y, y(0) = 0$ in the range $0 \le x \le 3$ by taking $h = 0.1$ by the modified Euler's method.

5. Construct the dual of the L.P.P.

   Maximize $z = 4x_1 + 9x_2 + 2x_3$

   subject to $2x_1 + 3x_2 + 2x_3 \le 7, 3x_1 - 2x_2 + 4x_3 = 5 ; x_1, x_2, x_3 \ge 0$.

($5 \times 3 = 15$ marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Show that $\sqrt{|xy|}$ is not analytic at the origin, although Cauchy-Riemann equations are satisfied at the point.

7. Find the Taylor's series expansion of $f(z) = \frac{2z^3+1}{z^2+z}$ about $z = i$.

Turn over

8. Find by the iteration method, a real root of $2x - \log_{10} x = 7$.

9. Solve $\frac{dy}{dx} = x + z, \frac{dz}{dx} = x - y^2$ with $y(0) = 2$, $z(0) = 1$ to get $y(0.1)$, $y(0.2)$, $z(0.1)$ and $z(0.2)$ approximately by Taylor's series.

10. Using graphical method, solve the following L.P.P.

Maximize $z = 2x_1 + 3x_2$

subject to $x_1 - x_2 \leq 2$

$x_1 + x_2 \geq 4$,

$x_1, x_2 \geq 0$.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. (a) Determine the analytic function $f(z) = u + iv$ if $u - v = \frac{\cos x + \sin x - e^{-y}}{2(\cos x - \cosh y)}$ and $f(\pi/2) = 0$.

(6 marks)

(b) Find the bilinear transformation which maps the points $z = 1, i, -1$ into the points $w = i, 0, -i$. Hence find the image of $|z| < 1$.

(6 marks)

Or

12. (a) Prove that the function $f(z)$ defined by $f(z) = \frac{x^3(1+i) - y^3 1 - i}{x^2 + y^2}$, $z \neq 0$ and $f(0) = 0$ is continuous and the Cauchy-Riemann equations are satisfied at the origin, yet $f'(0)$ does not exist.

(6 marks)

(b) Show that the transformation $w = \frac{3 - z}{z - 2}$ transforms the circle with center $\left(\frac{5}{2}, 0\right)$ and radius $\frac{1}{2}$ in the z-plane into the imaginary axis in the w-plane and the interior of the circle into the right half of the plane.

(6 marks)

13. (a) Evaluate $\int_C \frac{z-3}{z^2+2z+5} dz$, where C is the circle (i) $|z| = 1$; (ii) $|z + 1 - i| = 2$; (iii) $|z + 1 + i| = 2$.

(8 marks)

(b) Determine the poles of the function $f(z) = \frac{x^2}{(z-1)^2 (z+2)}$ and the residue at each pole.

(4 marks)

Or

14. (a) Find the Laurent's expansion of $f(z)=\frac{7z-2}{(z+1)z(z-2)}$ in the region $1<|z+1|<3$. (5 marks)

(b) Show the method of residues, that $\int_0^{\pi}\frac{a}{a^2+\sin^2\theta}d\theta=\frac{\pi}{\sqrt{1+a^2}}$. (7 marks)

15. (a) Using Newton's iterative method, find the real root of $x\log_{10}x = 1.2$ correct to five decimal places.

(6 marks)

(b) Solve by Gauss-Seidel method :

$$10x + 2y + z = 9$$
$$2x + 20y - 2z = -44$$
$$-2x + 3y + 10z = 22.$$

(6 marks)

Or

16. (a) Find a real root of the equation $x^3 - x - 11 = 0$, correct to 4 decimal places using the bisection method.

(6 marks)

(b) Find the root of the equation $\cos x - xe^x = 0$ by secant method correct to four decimal places.

(6 marks)

17. Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx}=yz+x$, $\frac{dz}{dx}=xz+y$ given that $y(0) = 1$, $z(0) = -1$ for $y(0.2)$, $z(0.2)$.

Or

18. Apply Milne's method, to find a solution of the differential equation $y' = x - y^2$ in the range $0 \le x \le 1$ for the boundary condition $y = 0$ at $x = 0$.

19. (a) What is the maximization transport problem ? How do you solve it ? (3 marks)

(b) Using simplex method solve the LPP

Maximize $z = 5x_1 + 3x_2$

subject to $x_1 + x_2 \le 2$

$5x_1 + 2x_2 \le 10$

$3x_1 + 8x_2 \le 12$,

$x_1, x_2 \ge 0$.

(9 marks)

Or

20. Find the initial basic feasible solution of the following transportation problem by Vogel's approximation method (VAM). Here, F_1, F_2 and F_3 are factories, and W_1, W_2 and W_3 are warehouses.

	W_1	W_2	W_3	W_4	*Production of Factories*
F_1	21	16	25	13	11
F_2	17	18	14	23	13
F_3	32	27	18	41	19
Capacity of the warehouse	6	10	12	15	43

(5 × 12 = 60 marks)

F 3164 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Common to all Branches except C.S. and I.T.

ENGINEERING MATHEMATICS – IV (CMELPASUF)

(Old Scheme—Supplementary/Mercy Chance)

[Prior to 2010 admissions]

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*
Each full question carries 20 *marks.*

1. (a) Using Cauchy's integral formula, evaluate $\int_C \frac{z+1}{z^2+2z+5}\,dz$ where C is the circle $|z+1-i|=2$, integration being taken in the counter clockwise direction.

   (b) Expand $\frac{1}{z(z-1)(z-2)}$ in Laurent's series for $|z|>2$.

Or

2. (a) Evaluate $\oint_C \frac{z}{z(z-1)(z-2)^2}\,dz$, where C is the circle $|z-2|=\frac{1}{2}$.

   (b) Evaluate by contour integration $\int_0^\infty \frac{x^2\,dx}{(x^2+9)(x^2+4)^2}$.

3. (a) Find a root of the equation $x^6-x^4-x^3=1$ correct to three decimal places using Regula Falsi method.

   (b) Solve by Gauss-Jacobi's method :

$$\begin{aligned} 54x+y+z &= 110 \\ 2x+15y+6z &= 72 \\ -x+6y+27z &= 85. \end{aligned}$$

Or

Turn over

4. (a) Find a root of $x^3 - 4x - 9 = 0$ correct to three decimal places using Bisection method.

(b) Solve by Gauss-Seidel method :

$$10x_1 - 5x_2 - 2x_3 = 3$$
$$4x_1 - 10x_2 + 3x_3 = -3$$
$$x_1 + 6x_2 + 10x_3 = -3.$$

5. (a) Using Taylor's series method solve $\frac{dy}{dx} = x^2 - y, y(0) = 1$ at x = 0.1, 0.2, 0.3 and 0.4.

(b) Use Runge-Kutta method to solve $\frac{dy}{dx} = x^2 - $ [illegible], $y(1) = 1.5$ at x = 1.2 in steps of 0.1.

Or

6. (a) Taking h = 0.05 and applying modified Euler's method, solve the initial value problem $y' = x^2 + y, y(0) = 1$, obtain y (0.1).

(b) Using Milne's predictor-corrector method solve the initial value problem $\frac{2dy}{dx} = \left(1 + x^2\right)y^2, y(0) = 1$ and obtain y (0.4). Use the solution values :

$y(0.1) = 1.06, y(0.2) = 1.12, y(0.3) = 1.21.$

7. (a) Given $Z(u_n) = \frac{2z^2 + 3z + 4}{(z-3)^3}, |z| > 3$, show that $u_1 = 2, u_2 = 21, u_3 = 139$.

(b) Solve $x_{n+1} - y_n = 1, y_{n+1} - x_n = 0, x_0 = 0, y_0 = -1$.

Or

8. (a) Find the z-transform of :

(i) $e^{4t} \sin 3t$.

(ii) $(t + T)e^{-(t+T)}$.

(iii) $4^n + \left(\frac{1}{2}\right)^n + u(n-3)$.

(b) Find the inverse z-transform of $\frac{4z^2 - 2z}{z^3 - 5z^2 + 8z - 4}$.

9. (a) Solve the following L.P.P. by simplex method :

Maximize $Z = x_1 + 2x_2 + 3x_3 - x_4$

subject to
$$x_1 + 2x_2 + 3x_3 = 15$$
$$2x_1 + x_2 + 5x_3 = 20$$
$$x_1 + 2x_2 + x_3 + x_4 = 10.$$

(b) Solve the following transportation problem :

		Destination				Avail
		D_1	D_2	D_3	D_4	
	O_1	5	3	6	2	19
Origin	O_2	4	7	9	1	37
	O_3	3	4	7	5	34
Require		16	18	31	25	

Or

10. (a) Using the duality theory, solve the L.P.P. :

Minimize $Z = 3x_1 - 2x_2 + 4x_3$

subject to
$$3x_1 + 5x_2 + 4x_3 \geq 7$$
$$6x_1 + x_2 + 3x_3 \geq 4$$
$$7x_1 - 2x_2 - x_3 \leq 10$$
$$x_1, x_2, x_3 \geq 0.$$

(b) Apply Vogel's method to find the transportation cost to the following transportation model :

	1	2	3	4	
1	10	2	20	11	15
2	12	7	9	20	25
3	4	14	16	18	10
	5	15	15	15	

(5 × 20 = 100 marks)

F 3200 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Electrical and Electronics Engineering

LINEAR INTEGRATED CIRCUITS (E)

(Old Scheme—Supplementary/Mercy Chance)

[Prior to 2010 Admissions]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions briefly.*
Each question carries 4 *marks.*

1. What is a level translator ? Where it is used in 741 ? What is its function ?
2. Draw the equivalent circuit of an op-amp and explain its parameters.
3. Draw the circuit of a regenerative comparator and explain its voltage transfer characteristics.
4. Explain the functioning of a sample and hold circuit, giving its applications.
5. Explain the advantages of active filters.
6. Compare and contrast the merits of parallel and dual slope ADC.
7. Describe the lock range and capture range of a PLL on its characteristics.
8. Explain how PLL can be used for FM demodulation.
9. Draw the circuit of a shunt zener voltage regulator and explain how it regulates the output voltage when the input increases.
10. Discuss the applications of 555.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. (a) Define the following parameters of op-amp :—

    (i) Input bias current. (ii) Input offset current.

    (iii) CMRR. (iv) SVRR.

(8 marks)

Turn over

(b) An op-amp has a differential gain of 90 dB and CMRR of 100 dB. If $V_1 = 1\ \mu V$ and $V_2 = 0.8\ \mu V$, calculate the differential and common mode output voltage.

(4 marks)

Or

12. Draw the temperature compensated logarithmic amplifier using op-amp and diode. Explain its working and derive expression for its output voltage.

13. (a) Draw the circuit of a Schmitt trigger for LTP = + 2 volt and UTP = + 5.5 volt. Design your circuit and derive the formula used.

(8 marks)

(b) Draw the circuit of a precision full-wave rectifier and explain with its waveforms. (4 marks)

Or

14. With circuit and necessary waveforms, explain the working of an astable multivibrator which generates square waves of 600 Hz with 60 % duty cycle. Derive expression for its frequency.

15. Explain the circuit of a R-2R DAC. Derive expression for its output voltage. Assume input is 4 bits.

Or

16. With the help of neat diagrams, explain the working of an ADC which does not require the reconversion of digital output to its analog equivalent.

17. With necessary circuit diagram, describe how PLL can be used as a frequency multiplier.

Or

18. Describe the AM demodulator operation by PLL. What are its merits compared to other AM detectors ?

19. With internal functional block diagram and waveform explain how 555 can be used as a monostable multivibrator. Show how this can be used as a divide-by-3 counter. Draw waveforms.

Or

20. With functional internal block diagram, explain how 723 works. Show the circuit diagrams for a output voltage of 10 volt, with foldback protection, $I_{Lmax} = 200$ mA.

(5 × 12 = 60 marks)

F 3624 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Aeronautical Engineering/Computer Science/Electrical and Electronics Engineering

EN 010 502 – PRINCIPLES OF MANAGEMENT (AN, CS, EE)

(New Scheme – 2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 3 *marks.*

1. Define : Vision.
2. What is personal management?
3. State the limitations of production.
4. State the importance of financial management.
5. What is pricing?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. State the objectives of management.
7. State the importance of manpower planning.
8. State the advantages of project planning.
9. State the methods of financing.
10. What is channels of distribution?

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*

Each question carries 12 *marks.*

11. (a) Explain about the management concepts in detail.

Or

(b) Write in detail about the organizational structure.

Turn over

12. (a) Explain the importance of training and development.

Or

(b) Explain the labour welfare and its benefits.

13. (a) Explain the functions of production management in detail.

Or

(b) Briefly explain the production process and its types.

14. (a) Explain in detail about the cost management.

Or

(b) Write in detail about the factors affecting working capital.

15. (a) Explain the duties of sales managers and state the importance of packaging.

Or

(b) Explain the advertising and other sales promotions in detail.

(5 × 12 = 60 marks)

F 3637 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Electrical and Electronics Engineering

EE 010 503 – SIGNALS AND SYSTEMS (EE)

(New Scheme – 2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 3 *marks.*

1. Define signal and system. Give an example.
2. Define inverse Fourier transform.
3. Define power spectral density.
4. Distinguish FIR and IIR systems.
5. Define symmetric network.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Explain the classification of signal with examples.
7. Find the Fourier transform of rectangular pulse.
8. Explain autocorrelation for energy signals.
9. Write down the effects of under sampling.
10. Explain characteristics impedance.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*

Each question carries 12 *marks.*

11. Explain the classifications of continuous time systems.

Or

12. Derive the mathematical expression for continuous time Fourier series.

Turn over

13. Find the Fourier transform for the given signal (a) Sine ; (b) Triangular.

Or

14. Explain the properties of Fourier transform.

15. Derive the cross correlation of energy and power signals.

Or

16. Define convolution and correlation. Explain convolution theorem.

17. Explain reconstruction of signal with neat sketch.

Or

18. Find the natural and forced response of an LTI system given by :

$10dy(t)/dt + 2y(t) = x(t)$?

19. Explain the properties of symmetrical two port network.

Or

20. Write a short note on m-derived T and PI sections.

(5 × 12 = 60 marks)

F 3648 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Electrical and Electronics Engineering

EE 010 504 : POWER ELECTRONICS (EE)

(New Scheme—2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 marks.

1. What is the difference between power diode and signal diode ?
2. Mention some of the applications of controlled rectifier.
3. What is meant by step-up and step-down chopper ?
4. What are the applications of an inverter ?
5. What are the industrial applications of SMPS ?

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 marks.

6. Explain the characteristics of SCR.
7. Describe the working of 1 ϕ fully controlled bridge converter in the rectifying mode.
8. Describe the basic working principle of single phase cyclo converter.
9. Describe the operation of series inverter with aid of diagrams.
10. Explain the basic operation of fly back converter.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*
Each question carries 12 marks.

11. Describe the various methods of thyristor turn on.

Or

12. Explain the switching characteristics of MOSFET and GBT.

Turn over

13. Describe the working of Dual converter.

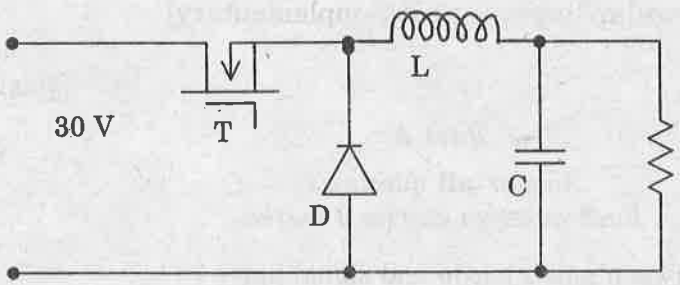
Or

14. Describe the working of 3 ϕ fully controlled bridge converter in the rectifying mode for firing angle of 30°.

15. Derive an expression for the average output voltage in terms of input d.c. voltage and duty cycle for step-up and step-down chopper.

Or

16. Figure 1 shows A non-isolated buck converter operating at a duty ratio of 0.5 at a switching frequency of 20 kHz. The components may be taken to be ideal.



T_S = 50 μS
C = 500 μF
R = 50 Ω
D = 0.5

Fig. 1. A Non-isolated Buck Converter

Evaluate the value of L such that the converter operates in the discontinuous mode.

17. Explain the operation of 3ϕ bridge inverter for 120 degree mode of operation with aid of relevant phase and line voltage waveforms.

Or

18. State different methods of voltage control inverters. Describe about PWM control in inverter.

19. Explain the operation of buck regulator for continuous current mode with aid of relevant waveforms and derive the expression of ripple voltage.

Or

20. Explain the DCM operation of Fly back converter with relevant circuit diagram and waveforms.

(5 × 12 = 60 marks)

F 3660 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Electrical and Electronics Engineering

EE 010 505 – LINEAR INTEGRATED CIRCUITS (EE)

(New Scheme – 2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 3 *marks.*

1. Define CMRR rate and its effect in detail.
2. Draw the equivalent circuit of *op-amp* and explain.
3. Draw *op-amp* multiplier using log amplifier and derive its design equations.
4. Explain the advantages and applications of all pass filter with an example.
5. Explain the application of PLL as FSK demodulator.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Draw the *op-amp* unity gain amplifier and explain it in detail. Derive its Vo.
7. Draw *op-amp* zero crossing detector and explain its principle in detail.
8. Explain the characteristics of Notch filter in detail.
9. Explain the applications and limitations of SMPS.
10. Draw the functional block diagram of 565 PLL timer and explain it in detail.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*

Each full question carries 12 *marks.*

11. (i) Explain the applications of *op-amp* as inverting, non-inverting amplifiers, sign changer and subtractor with neat diagrams. Derive their Vo expressions.

    (ii) Derive an expression for CMRR for a basic differential amplifier.

Or

Turn over

12. (i) Explain the characteristics of a practical *op-amp* in detail.

(ii) Explain the frequency response of *op-amp* with neat diagram.

13. (i) Draw *op-amp* integrator and differentiator. Explain them. Bring out its design details.

(ii) Design a *op-amp* differentiator to differentiate an input signal that varies in frequency from 100 Hz to about 1 KHz.

(iii) Draw *op-amp* peak detector and explain it detail.

Or

14. (i) Draw *op-amp* log and antilog amplifiers and explain them. Derive their Vo expressions.

(ii) Draw *op-amp* instrumentation amplifier and explain it.

15. (i) Differentiate active filter from passive filter.

(ii) Draw an *op-amp* second order LPF and explain it. Derive its design equations.

Or

16. (i) Give an account on "Higher order filters".

(ii) Draw an *op-amp* first order HPF and explain it . Bring out its design equations.

17. Draw an *op-amp* Wien bridge oscillator and explain it in detail. Derive the condition for oscillation.

Or

18. Draw a neat schematic of SMPS. Explain its principle of working in detail. Explain its applications. Differentiate SMPS from linear mode power supply.

19. (i) Draw a monostable using IC 555 and explain it in detail.

(ii) Explain the application of PLL as frequency divider with a neat diagram.

Or

20. Write technical notes on :

(i) IC 565 for AM detection.

(ii) Capture and lock range of PLL.

(iii) Applications of astable multivibrator.

(5 × 12 = 60 marks)

F 3670 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Electrical and Electronics Engineering

EE 010 506 – MICROPROCESSORS AND APPLICATIONS (EE)

(New Scheme – 2010 Admission onwards)

[Regular/Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 3 *marks.*

1. What is the difference between microprocessor and microcontroller? Explain.
2. What is an ALP? Explain with an example.
3. Explain the types of interrupt with an example.
4. Differentiate ROM from RAM. Explain the difference.
5. Explain the concept of memory segmentation.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*

Each question carries 5 *marks.*

6. Discuss the evolution of microprocessors in detail.
7. Explain any *three* addressing modes of intel 8085 in detail.
8. What are SIM and RIM instructions? Explain.
9. What is the concept of DMA controller? Explain in detail.
10. Enumerate the addressing modes of INTEL 8086 . Explain any *two* in detail.

(5 × 5 = 25 marks)

Part C

Answer **all** *questions.*

Each full question carries 12 *marks.*

11. (i) Explain the architecture of 8085 with a neat diagram.

    (ii) Explain the structure of ALU with a neat diagram.

Or

Turn over

12. (i) Explain the timing diagram and its significance.

(ii) Explain the terms T state, Machine cycle and instruction cycle with respect to execution of instructions.

13. (i) Explain the classification of instructions of intel 8085 in detail.

(ii) Write an ALP to multiply two 8-bit numbers stores at 2000H and 2001H and display the result in the address field of the microprocessor kit.

Or

14. (i) Write an ALP to arrange numbers in a data array in ascending and descending orders.

(ii) Write an ALP to find smallest and largest number in a given data array.

15. (i) Explain the subroutines with examples.

(ii) Give an account on "Vectored and non-vectored interrupts".

Or

16. (i) Explain the interfacing of 8279 key board with a neat diagram.

(ii) Draw the block diagram of 8251 and explain it detail.

17. Explain the block diagram of IC 8255 in detail.

Or

18. (i) Explain the following in detail :

(a) PPI.

(b) Interfacing I/Os using decoders.

(ii) Give an account on "memory mapped I/O and I/O mapped I/O schemes".

19. (i) Explain the logic pin diagram of intel 8086 in detail.

(ii) Explain the operating modes of intel 8086 with examples.

Or

20. (i) Explain the addressing modes of intel 8086 in detail.

(ii) Explain the purpose of memory banks with an example.

(5 × 12 = 60 marks)

F 3208 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Fifth Semester

Branch : Electrical and Electronics Engineering

POWER ELECTRONICS (E)

(Old Scheme – Prior to 2010 Admissions)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 4 *marks.*

1. Draw the static $v - i$ characteristics of a GTO and mark the salient features and operating modes / regions.
2. Draw the dynamic characteristics of a thyristor and show the reverse recovery charge in the characteristics.
3. In a circuit a thyristor with a gate-threshold current of 5.5 mA is subjected to a re-applied $\frac{dV}{dt}$ of 1300 $V/\mu s$. If, at this rate the thyristor turns ON without applying any gate pulse, evaluate the minimum possible value of the junction capacitance, assuming it to be a constant.
4. Two thyristors are connected in anti-parallel (parallel with back-to-back) in a circuit. A triggering circuit generates triggering pulses to these thyristors simultaneously. Do these pulses need to be electrically isolated? Give reasons for your answer with relevant illustrations.
5. Is it possible for a single-phase/three-phase fully controlled converter connected to all R-L load to operate continuously with firing angle $0 > 90°$? (There is no free-wheeling diode present across the load). Give reasons for your answer.
6. What are the advantages and disadvantages of a semi-converter when compared to a fully controlled converter?
7. What is meant by complimentary current commutation in choppers?
8. Differentiate between step-up and step-down choppers.
9. Explain briefly the square-wave operation of single-phase inverters.
10. Explain the ramp-comparison method of firing pulse generation scheme for a fully controlled converter.

(10 × 4 = 40 marks)

Turn over

Part B

Answer **all** *questions.*

Each full question carries 12 *marks.*

11. (a) Explain the turn-on process in a thyristor from an equivalent circuit. point-of-view, with relevant equations.

(b) Draw the static v–i characteristics of an IGBT and indicate the regions ill which the IGBT operate as a switch.

(8 + 4 = 12 marks)

Or

12. (a) An SCR is used in a circuit as shown in the Figure 1. The SCR is in the ON condition. An additional resistance is introduced in to the circuit by closing the switch labelled 'S'. What should be the minimum value of 'R' for the SCR to turn OFF when 'S' is open? The holding current of the SCR is 150 mA.

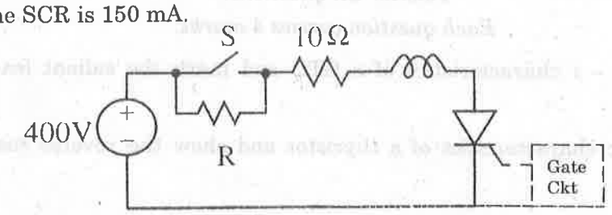


Figure 1 : A switching circuit [question 12(a)]

(b) A MOSFET is used in series with a diode, with the MOSFET's drain connected to the anode of the diode to form a composite switch. Show the polarity/polarities of the current(s) possible when the composite switch is in the ON condition and the polarities of voltage(s) which it will block when in the OFF condition in a $v - i$ plane.

(6 + 6 = 12 marks)

13. (a) A thyristor is used in a switching circuit. The power dissipated in the device is 100 W. If the thermal resistance of the device (from junction to casing) is 0.35° C/W. determine the thermal resistance (from sink to ambient) of the heat sink to be chosen in order to limit the device temperature at 110° C. The ambient temperature is 55° C.

(b) Draw the circuit of a line-synchronised relaxation oscillator with UJT for triggering a half-wave controlled rectifier.

(8 + 4 = 12 marks)

Or

14. (a) What are the issues in connecting thyristors in series? How are these addressed?

(b) Draw the RC-triggering circuit for a thyristor in a half-wave controlled rectifier and state the design considerations. What is the specific advantage of this circuit compared with R-trigger circuit?

(8 + 4 = 12 marks)

15. In a single-phase fully controlled bridge converter supplied from a 230 V, 50 Hz. a.c. bus. the no-load d.c. voltage is 150 V. The a.c. line reactance is 0.3 Ω. Determine the voltage drop due to commutation overlap for a d.c. load current of 10 A. At what value of load current will the average output voltage reduce to zero? Assume that d.c. load current is smooth, without any ripples.

Or

16. (a) A single-phase half-controlled converter is fed from an a.c. supply of 240V r.m.s. 50 Hz source. The converter feeds an RL load with large inductance. If the output average voltage at the load is 150V, estimate the firing angle for the thyristors. Show the waveform of the load voltage in this case.

(b) Draw the circuit diagram and waveforms for a three-phase half-wave converter operating with a firing angle of 60°.

17. Draw the schematic diagram of a 3-phase bridge inverter feeding star-connected resistive load. Show the triggering sequence for 120° conduction mode. Also show the waveforms of phase voltage and line-to-line of the load. Indicate the devices conducting during each interval.

(12 marks)

Or

18. (a) Explain the working of a series inverter with relevant waveforms.

(b) Which commutation scheme is employed in Mc Murray Inverter? Explain its working.

(6 + 6 = 12 marks)

19. (a) Give the schematic diagram and waveforms of a Type-C chopper. Indicate the quadrants in which it operates in a $v - i$ plane.

(b) What is a cycloconverter? What are its applications?

(6 + 6 = 12 marks)

Or

20. (a) A step-down chopper is supplied from a d.c. voltage of 400 V, and is connected to a highly inductive load. The switching frequency is 1 kHz. If the ON period of the switching device is 0.49 ms, sketch the voltage waveform across the R-L load, and find out the r.m.s. and average output voltage.

(b) Explain the cosine-comparison method of firing pulse generation.

(6 + 6 = 12 marks)

[5 × 12 = 60 marks]