

**MAHATMA GANDHI  
UNIVERSITY**

**B.TECH. DEGREE COURSE**

**5<sup>TH</sup> SEMESTER**

**SCHEME  
&  
SYLLABUS**

**2002**

**ELECTRICAL  
&  
ELECTRONICS  
ENGINEERING BRANCH**

# ELECTRICAL & ELECTRONICS ENGINEERING

## SCHEME

### 5<sup>TH</sup> SEMESTER

Course Code	Course No.	Subject	Teaching Hours				Duration of Univ. Exam(Hrs.)	Maximum Marks		
			L	T	P	Total		Sessional	University	Total
A	CMEL PA 501	Engineering Mathematics -IV	3	1		4	3	50	100	150
B	E 502	Digital Circuits	3	1		4	3	50	100	150
C	E 503	Communication Engineering	2	1		3	3	50	100	150
D	E 504	Industrial management and Economics	3	2		5	3	50	100	150
E	E 505	Linear Integrated Circuits	2	1		3	3	50	100	150
F	E 506	Power Electronics	2	1		3	3	50	100	150
G	E 507	Electrical Machines Lab - I			4	4	3	50	100	150
H	E 508	Electronic Circuits Lab			4	4	3	50	100	150
		Total	15	7	8	30	24	400	800	1200

# SYLLABUS

## ENGINEERING MATHEMATICS - IV

CMELPA 501

3+1+ 0

### Module 1

**Complex Integration:** Line integral – Cauchy’s integral theorem – Cauchy’s integral formula – Taylor’s series – Laurent’s series – Zeroes and singularities – residues – residue theorem – evaluation of real integrals using contour integration involving unit circle and semi circle.

### Module 2

**Numerical Solution of algebraic and transcendental equations:** Successive bisection method – Regula – Falsi method – Newton – Raphson method – solution of system of linear equation by Jacobi’s iteration method and Gauss – Sidel method.

### Module 3

**Numerical solution of Ordinary Differential Equations:** Taylor’s series method – Euler’s method – Modified Euler’s method – Runga – Kutta method (IV order) Milne’s predictor-corrector method.

### Module 4

**z - Transforms:** Definition of z – transforms – properties – z-transform of polynomial functions – trigonometric functions, shifting property, convolution property – inverse transform – solution of first and second order difference equations with constant coefficients using z-transforms.

### Module 5

**Linear Programming:** Graphical solution – solution using simplex method (non-degenerative only) – duality in LPT – balanced TP – Vogel’s approximation method – Modi method.

### References

1. Advanced Engg. Mathematics: Erwin Kreyszig, Wiley Eastern.
2. Numerical Methods in Engg. and Science : Grawal B. S, Khanna Publ.
3. Higher Engg. Mathematics: Grawal B. S, Khanna Publ.
4. Numerical Methods in Science and Engg.: M. K Venkataraman, National Publishing Co.
5. Quantitative techniques: Theory and Problems: P.C Tulsian and Vishal Pandey, Pearson Education Asia
6. Complex Variable and Applications: Churchill and Brown, McGrawHill
7. Engineering Mathematics Vol.3: S.Arumugam, A.T Issac and A.Somasundaram, Scitech Publ.

8. Advanced Mathematics for Engineering students Vol-3: S. Narayanan, T.K.M Pillai & G. Ramanaiah, S.Viswanathan Printers & Publ.
9. Operations Research: Paneer Selvam, PHI

## **DIGITAL CIRCUITS**

**E 502**

**3+1+0**

### **Module 1**

**Number Systems and Codes:** Arithmetic using signed and unsigned numbers- Floating point representation- Normalized floating point representation- Gray Codes, ASCII and EBCDIC code.

**Logic gates:** Elements of Boolean algebra- Logic operations- AND, OR, NOT, NAND, NOR, XOR gates- De Morgan's Theorem- Realisation of combinational circuits using SOP and POS forms - K-map up to 4 variables- Half adder, full adder circuits. Half subtraction and Full subtraction circuits.

### **Module 2**

**Logic Families:** DTL, TTL and CMOS families- comparison of characteristics- TTL NAND gate internal circuit- TTL characteristics- sinking and sourcing- fan-in and fan-out – CMOS characteristics – CMOS NAND and NOR gates.

**Decoders:** BCD to decimal, BCD to 7 Segment decoders- Encoders- Multiplexer- Demultiplexer.

### **Module 3**

**Sequential Circuits:** JK Flip-flops- SR JK, T and D flip-flops- buffers- Tri-state buffers- racing- JK master-slave FF. Truth table and excitation table- conversion of flip-flops from one type to another.

**Asynchronous counters:** Ripple counter- disadvantages- Decoding errors- maximum frequency of the counter – modulo N ripple counter using CLEAR and PRESET inputs. Asynchronous UP- DOWN counters.

### **Module 4**

**Synchronous Counters:** Methods to improve counter speed- synchronous serial and parallel counters – synchronous counter design – modulo N counter design for completely specific count sequence – lockout, design without lockout – Synchronous UP/DOWN counters. Counter IC 7490.

### **Module 5**

**Shift Registers:** SISO, PIPO, PISO, PIPO types – Universal shift registers.

**Counters using Shift Registers:** Ring counter – twisted ring counter- Design for self starting ring counter.

## **References**

1. Digital Principles and Applications: Malvino & Leach, TMH

2. Digital Fundamentals: Thomas L. Floyd
3. Digital Integrated Electronics: Taub & Schilling, McGraw Hill Intl.
4. Digital Electronics and Microcomputers: R.K. Gaur, Dhanpat Rai & sons
5. Engineering Approach to Digital Design: Fletcher – EEE Edition

## **COMMUNICATION ENGINEERING**

**E 503**

**2+1+0**

### **Module 1**

**Modulation:** Need for modulation, Amplitude modulation–Definition-Mathematical representation - Frequency spectrum - Power relations. Principle of single side band transmission – Advantages - Disadvantages. Frequency modulation – Definition – Mathematical representation - Frequency spectrum, Comparison between FM and AM.

### **Module 2**

**Transmitter:** AM transmitter – high level and low-level systems - functional description of each block. FM transmitter – FET & BJT modulator.

**Receiver:** AM receiver – TRF receiver – Limitations. Superhetrodyne receiver – block schematic, choice of IF, image signal rejection.

### **Module 3**

**Television:** Composite video signal – synchronizing pulse – blanking pulse-equalizing pulse, Video BW, Positive and negative modulation, Vestigial side band transmission, Television standards, Block schematic of monochrome TV transmitter and receiver.

Colour Television: Compatibility, characteristics of colour transmission and reception, luminance, hue & saturation, colour difference signal, I & Q signals, frequency interleaving, colour sub carrier.

### **Module 4**

**Radar:** Basic radar system, radar range equation – performance factors, Pulsed radar, Continuous wave radar – advantages-limitations-applications, CW radar, MTI radar system. Radio navigational aids – ILS – GCA.

### **Module 5**

**SATELLITE COMMUNICATION:** Geo-synchronous satellites – advantages and disadvantages, uplink & downlink, multiple access techniques – Basic principles of FDMA, TDMA, DA-FDMA, DA-TDMA.

### **References**

1. Electronic Communication Systems: George Kennedy, TMH
2. Electronic Communication Systems: Wayne Tomasi, Pearson Education, LPE

3. Monochrome and Colour Television: R.R Gulati, Wiley Eastern
4. Introduction to Radar Systems: Skoluik, McGraw Hill Intl.
5. Satellite Communications: D.C Agarwal, Khanna
6. Radio Engineering: Mithal, Khanna

## **INDUSTRIAL MANAGEMENT AND ENGINEERING ECONOMICS**

**E 504**

**3+2+0**

### **PART A: INDUSTRIAL MANAGEMENT**

#### **Module 1**

**Modern Concepts of Management:** Scientific management – functions of management – planning – organizing – staffing – directing – motivating – communicating – coordinating – controlling – Organisational structures – line, line and staff, and functional relationships – Span of control – delegation – Management by objectives.

#### **Module 2**

**Personnel Management:** Objectives and functions of personnel management – recruitment – selection and training of workers – labour welfare – industrial fatigue – Industrial disputes – Trade unions – Quality circles.

**Formation of Companies:** Proprietary – Partnership – joint stock companies – public sector – joint sector and cooperative sector.

#### **Module 3**

**Marketing Management:** Pricing – Promotion – Channels of distribution – Market research – Advertising.

**Production Management:** Batch and mass production – inventory control – EOQ – Project planning by PERT /CPM – Construction of network (Basic Ideas only)

#### **References**

1. Industrial Management: O.P. Khanna
2. Industrial Management: K.K Ahuja
3. Marketing Management: Philip Kotler

### **PART B: ENGINEERING ECONOMICS**

#### **Module 4**

Theory of demand and supply – price mechanisms – factors of production – land, labour, capital and organisation – National income – Difficulties in estimation – Taxation – Direct and indirect taxes – Progressive and regressive – black money – inflation – Causes and consequences.

## Module 5

Indian Financial System – Reserve bank of India – Functions – Commercial banking system – Development financial institutions – IDBI – ICICI – SIDBI – IRBI – NABARD – Investment institutions – UTI – Insurance companies – Indian capital market – Stock market – Functions – Role of the public sector – Privatisation – Multinational corporations and their impact on the Indian economy.

## References

1. Indian Economy: A.N Agarwal
2. Modern Economic Theory: K.K. Dewett
3. Principles of Economics: K.P.M. Sundharam & M.C Vaish.

## LINEAR INTEGRATED CIRCUITS

E 505

2+1+0

### Module 1

**Operational Amplifiers:** Differential amplifier – block diagram of a typical op amp – characteristics of an ideal op-amp – definitions of CMRR – slew rate – input offset voltage – differential input resistance – input voltage range – SVRR – large signal voltage gain – output voltage swing – output resistance – open-loop configurations – disadvantages – closed-loop configurations – non inverting amplifier – voltage follower – inverting amplifier – summing and scaling amplifier – integrator – differentiator – logarithmic amplifier.

### Module 2

Basic Comparator: Astable and mono stable multivibrators - Schmitt trigger – zero crossing detector – precision rectifier – peak detector – sample and hold circuit – function generator (no analysis).

### Module 3

**Active filters:** First order low pass filter, high pass filter, band pass filter, band reject filter (twin T notch filter). D/A converter – binary weighted resistor type – ladder type – A/D converter – simultaneous A/D converter – counter type – successive approximation converter – dual-slope converter – Digital voltmeter.

### Module 4

**Phase-locked-loop:** Basic principles of PLL – block diagram – transfer characteristics – applications of PLL as FM demodulator, AM demodulator and frequency multiplier.

### Module 5

**Timer:** The 555 timer – functional block diagram – astable and mono-stable operation of 555 timers.

**Regulated Power Supplies:** Zener voltage regulator – series voltage regulator using transistors (analysis not required) – Series op-amp regulator – IC voltage regulator – 723/317 general purpose switching regulator.

## References

1. Op-amp and Linear Integrated Circuits: Ramakant Gayakwad, Pearson Education Asia, 4/e, LPE
2. Integrated Electronics: Millman and Halkias
3. Integrated Circuits: Botkar K.R
4. Linear IC: Roy Choudhary
5. Op-amp and Linear IC: Robert F. Coughlin
6. Electronic Devices and Circuit Theory: Robert L. Boylestad and Louis Nashelsky

## POWER ELECTRONICS

E 506

2+1+ 0

### Module 1

**Power Semiconductor Devices:** Power diodes, Power Transistors, Power MOSFET, IGBTs, Diac, Triac, GTOs – static characteristics and principle of operation.

**SCRs:** Static and dynamic characteristics – two transistor analogy – gate characteristics

### Module 2

SCR ratings and specifications - Device protection – heat sink selection – series and parallel operation of SCRs.

SCR Triggering circuits – R, RC, UJT triggering circuits – diac triggering circuit – single pulse, continuous pulse carrier frequency triggering – pulse transformer – amplification and isolation of SCR gate pulses.

### Module 3

**Phase control:** single phase half wave controlled rectifier circuit – single phase full wave controlled rectifier circuit – R, RL Loads – free wheeling – half controlled and fully controlled bridge with continuous and steady current – Expression for output voltage – wave forms – active and reactive power – effect of source inductance – line commutated inverter – 3-phase half wave and full wave controlled rectifier – expression for output voltage.

### Module 4

**Commutation of SCRs** – classification of commutation schemes

**Inverters:** series and parallel inverters – single phase and three phase bridge inverters (schematic diagrams and wave forms only) – Mc Murray Inverter – Basic Principle of PWM.

### **Module 5**

**Choppers:** Basic principle – Classification – Type A, B, C, D and E. (Analysis not required)

Basic Principle of Cycloconverters.

**Control Circuits:** Generation of control pulses – block schematic of firing circuits – linear and cosine comparison – Digital firing scheme.

### **References**

1. Power Electronics – Circuits, Devices and Applications, M.H. Rashid, PHI/Pearson Edn.
2. Power Electronic Systems – Theory and Design, Jai P. Agarwal, Pearson Education Asia, LPE
3. Power Electronics, P.S Bhimbhra, Khanna publ., New Delhi
4. A Text Book of Power Electronics, S.N Singh, Dhanpat Rai & Co, 2000
5. Power Electronics – Converters, Applications and Design, Mohan N, Undeland T.M and Robbins W.P, John Wiley -1989
6. Power Electronics, Harish C. Rai, Galgotia Publ.

## ELECTRICAL MACHINES LAB - I

E 507

0+0+4

### D.C. Machines

1. Study of 3-point and 4-point starters for D.C machines – mode of connection – protective arrangements
2. OCC of self and separately excited D.C machines – critical resistances of various speeds. Voltage built-up with a given field circuit resistance. Critical speed for a given field circuit resistance
3. Load test on shunt and compound generator – deduce external, internal and armature reaction characteristics. Find load critical resistance.
4. Characteristics of D.C series machine as motor and generator.
5. Swineburne's and retardation test on D.C machines.
6. Brake test on D.C shunt, compound motors and determination of characteristics.
7. Hopkinson's test on a pair of D.C machines.
8. Separation of losses in a D.C machine.
9. Field's test on D.C machine.

### Transformers

10. Polarity, transformation ratio, tests of single phase units and star-delta combination for 3-phase operation.
11. O.C and S.C tests on single phase transformers – calculation of performance using equivalent circuit – efficiency, regulation at unity, lagging and leading power factors. Verification by direct loading.
12. Sumpner's test on single phase transformers.
13. O.C and S.C tests on three-phase transformers.
14. Scott connection – check for 2 phase – predetermination of primary current for balanced and unbalanced secondary currents – verification by actual loading.
15. Parallel operation and load sharing of two single phase dissimilar transformers.
16. Separation of losses of single phase transformer into Hysteresis and eddy current losses.
17. Paralleling of Three-phase transformers and load sharing.
18. Auto transformer – equivalent circuit.

## ELECTRONIC CIRCUITS LAB

E 508

0+0+4

1. Design and testing of clipping, clamping, RC integrator and differentiator circuits – Display of Transfer characteristics on CRO.
2. Design and testing of rectifier circuits – Half wave – Full wave (centre – tapped and bridge) circuits. Filter circuits.
3. Zener regulator design and testing.

4. BJT, FET and UJT characteristics.
5. Design and testing of CE amplifier – frequency response.
6. Design and testing of RC coupled and feedback amplifiers.
7. FET amplifier.
8. Sweep circuits – UJT and BJT based sweep generators – sweep circuit using constant current source (BJT).
9. Design and Testing of RC phase-shift Oscillator and LC Oscillator.
10. Design and Testing of Astable and Bi-stable Multi-vibrators.
11. Relay driving circuit using transistors.
12. Study of IC power amplifiers.

### **Optional**

Simulation of the above circuits using EDA tools like pSPICE.  
(Any experiment relevant to E 403 may be added)

### **References**

1. Electronic Principles: A.P. Malvino – TMH
2. Electronic Devices: Floyd – Pearson Education, LPE
3. Electronic Devices and Circuit Theory: Robert L. Boylestad and Louis Nashelsky, Pearson Education Asia, LPE.

