ENGINEERING MATHEMATICS – IV

CODE: 10 MAT 41 **IA Marks: 25**
Hrs/Week: 04 **Exam Hrs: 03**
Total Hrs: 52 **Exam Marks:100**

PART-A

Unit-I: NUMERICAL METHODS - 1

Numerical solution of ordinary differential equations of first order and first degree; Picard's method, Taylor's series method, modified Euler's method, Runge-kutta method of fourth-order. Milne's and Adams - Bashforth predictor and corrector methods (No derivations of formulae).

[6 hours]

Unit-II: NUMERICAL METHODS – 2

Numerical solution of simultaneous first order ordinary differential equations: Picard's method, Runge-Kutta method of fourth-order.
Numerical solution of second order ordinary differential equations: Picard's method, Runge-Kutta method and Milne's method.

[6 hours]

Unit-III: Complex variables – 1

Function of a complex variable, Analytic functions-Cauchy-Riemann equations in cartesian and polar forms. Properties of analytic functions.
Application to flow problems- complex potential, velocity potential, equipotential lines, stream functions, stream lines.

[7 hours]

Unit-IV: Complex variables – 2

Conformal Transformations: Bilinear Transformations. Discussion of Transformations: $w = z^2$, $w = e^z$, $w = z + (a^2 / z)$. Complex line integrals- Cauchy's theorem and Cauchy's integral formula.

[7 hours]

PART-B

Unit-V: SPECIAL FUNCTIONS

Solution of Laplace equation in cylindrical and spherical systems leading Bessel's and Legendre's differential equations, Series solution of Bessel's differential equation leading to Bessel function of first kind. Orthogonal property of Bessel functions. Series solution of Legendre's differential equation leading to Legendre polynomials, Rodrigue's formula.

[7 hours]

Unit-VI: PROBABILITY THEORY - 1

Probability of an event, empherical and axiomatic definition, probability associated with set theory, addition law, conditional probability, multiplication law, Baye's theorem.

[6 hours]

Unit-VII: PROBABILITY THEORY- 2

Random variables (discrete and continuous), probability density function, cumulative density function. Probability distributions – Binomial and Poisson distributions; Exponential and normal distributions.

[7 hours]

Unit-VIII: SAMPLING THEORY

Sampling, Sampling distributions, standard error, test of hypothesis for means, confidence limits for means, student's t-distribution. Chi -Square distribution as a test of goodness of fit

[6 hours]

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Latest edition, Khanna Publishers

2. Erwin Kreyszig, Advanced Engineering Mathematics, Latest edition, Wiley Publications.

Reference Book:

1. B.V. Ramana, Higher Engineering Mathematics, Latest edition, Tata Mc. Graw Hill Publications.
2. Peter V. O'Neil, Engineering Mathematics, CENGAGE Learning India Pvt Ltd.Publishers

MICROCONTROLLERS

(Common to EC/TC/EE/IT/BM/ML)

Sub Code	**:**	**10ES42**	***IA Marks***	**:**	**25**
Hrs/ Week	**:**	**04**	Exam Hours	**:**	**03**
Total Hrs.	**:**	**52**	**Exam Marks**	**:**	**100**

UNIT 1**:**

Microprocessors and microcontroller. Introduction, Microprocessors and Microcontrollers, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture, Computer software.

The 8051 Architecture: Introduction, Architecture of 8051, Pin diagram of 8051, Memory organization, External Memory interfacing, Stacks.

6 Hours

UNIT 2:

Addressing Modes: Introduction, Instruction syntax, Data types, Subroutines, Addressing modes: Immediate addressing , Register addressing, Direct addressing, Indirect addressing, relative addressing, Absolute addressing, Long addressing, Indexed addressing, Bit inherent addressing, bit direct addressing.

Instruction set: Instruction timings, 8051 instructions: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction.

6 Hours

UNIT 3**:**

8051 programming: Assembler directives, Assembly language programs and Time delay calculations. 6 Hours

UNIT 4**:**

8051 Interfacing and Applications: Basics of I/O concepts, I/O Port Operation, Interfacing 8051 to LCD, Keyboard, parallel and serial ADC, DAC, Stepper motor interfacing and DC motor interfacing and programming

7 Hours

UNIT 5:

8051 Interrupts and Timers/counters: Basics of interrupts, 8051 interrupt structure, Timers and Counters, 8051 timers/counters, programming 8051 timers in assembly and C .
6 Hours

UNIT 6:

8051 Serial Communication: Data communication, Basics of Serial Data Communication, 8051 Serial Communication, connections to RS-232, Serial communication Programming in assembly and C.

8255A Programmable Peripheral Interface:, Architecture of 8255A, I/O addressing,, I/O devices interfacing with 8051 using 8255A.

6 Hours

Course Aim – The MSP430 microcontroller is ideally suited for development of low-power embedded systems that must run on batteries for many years. There are also applications where MSP430 microcontroller must operate on energy harvested from the environment. This is possible due to the ultra-low power operation of MSP430 and the fact that it provides a complete system solution including a RISC CPU, flash memory, on-chip data converters and on-chip peripherals.

UNIT 7:

Motivation for MSP430microcontrollers – Low Power embedded systems, On-chip peripherals (analog and digital), low-power RF capabilities. Target applications (Single-chip, low cost, low power, high performance system design).

2 Hours

MSP430 RISC CPU architecture, Compiler-friendly features, Instruction set, Clock system, Memory subsystem. Key differentiating factors between different MSP430 families.

2 Hours

Introduction to Code Composer Studio (CCS v4). Understanding how to use CCS for Assembly, C, Assembly+C projects for MSP430 microcontrollers. Interrupt programming.

3 Hours

Digital I/O – I/O ports programming using C and assembly, Understanding the muxing scheme of the MSP430 pins. **2 Hours**

UNIT 8:

On-chip peripherals. Watchdog Timer, Comparator, Op-Amp, Basic Timer, Real Time Clock (RTC), ADC, DAC, SD16, LCD, DMA.

2 Hours

Using the Low-power features of MSP430. Clock system, low-power modes, Clock request feature, Low-power programming and Interrupt.

2 Hours

Interfacing LED, LCD, External memory. Seven segment LED modules interfacing. Example – Real-time clock.

2 Hours

Case Studies of applications of MSP430 - Data acquisition system, Wired Sensor network, Wireless sensor network with Chipcon RF interfaces.

3 Hours

TEXT BOOKS:

1. "The 8051 Microcontroller and Embedded Systems – using assembly and C "-, **Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006**
2. "MSP430 Microcontroller Basics", **John Davies, Elsevier, 2010**

(Indian edition available)

REFERENCE BOOKS:

1. "The 8051 Microcontroller Architecture, Programming & Applications", **2e Kenneth J. Ayala ;, Penram International, 1996 / Thomson Learning 2005.**
2. **"**The 8051 Microcontroller", **V.Udayashankar and MalikarjunaSwamy, TMH, 2009**
3. MSP430 Teaching CD-ROM, **Texas Instruments, 2008 (can be requested** http://www.uniti.in **)**
4. Microcontrollers: Architecture, Programming, Interfacing and System Design",**Raj Kamal, "Pearson Education, 2005**

10ES43 CONTROL SYSTEMS (Common to EC/TC/EE/IT/BM/ML)

Subject Code	:	10ES43	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART – A

UNIT 1:
Modeling of Systems: Introduction to Control Systems, Types of control systems, Effect of feedback systems, Differential equations of physical systems – Mechanical systems- Friction, Translational systems (Mechanical accelerometer, Levered systems excluded), Rotational systems, Gear trains. Electrical systems, Analogous systems. **6 Hours**

UNIT 2:
Block diagrams and signal flow graphs: Transfer functions, Block diagrams, Signal Flow graphs (State variable formulation excluded). **7 Hours**

UNIT 3:
Time Response of feed back control systems: Standard test signals, Unit step response of First and second order systems, Time response specifications, Time response specifications of second order systems, steady – state errors and error constants. **7Hours**

UNIT 4:
Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh-Hurwitz stability criterion, Relative stability analysis; Special cases of RH criterion. **6 Hours**

PART – B

UNIT 5:
Root–Locus Techniques: Introduction, basic properties of root loci, Construction of root loci. **6 Hours**

UNIT 6:
Stability analysis in frequency domain: Introduction, Mathematical preliminaries, Nyquist Stability criterion, (Inverse polar plots excluded), Assessment of relative stability using Nyquist criterion, (Systems with transportation lag excluded). **7Hours**

UNIT 7:
Frequency domain analysis: Correlation between time and frequency response, Bode plots, All pass and minimum phase systems, Experimental determination of transfer functions, Assessment of relative stability using Bode Plots. **7 Hours**

UNIT 8:
Introduction to State variable analysis: Concepts of state, state variable and state models for electrical systems, Solution of state equations. **6 Hours**

TEXT BOOK :

1. Control Systems Engineering, I. J. Nagarath and M.Gopal, New Age International (P) Limited, 4th Edition – 2005

2 Modern Control Engineering, K. Ogata, PHI, 5th Edition, 2010.

REFERENCE BOOKS:

1. **Control Systems Engineering,**Norman S Nise,Wiley Student Edition,5th Edition,2009
2. **Automatic Control Systems**, Benjamin C.Kuo and Farid Golnaaghi, Wiley Student Edition,8th Edition,2009
3. **Feedback and Control Systems**,Joseph J Distefano III and other, Schaum's Outlines,TMH,2nd Edition,2007
4. **Control Systems**, Ananda Kumar, PHI,2009.

10EE44 FIELD THEORY

Subject Code	:	10EE44	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART – A

UNIT -1

a. Coulomb's Law and electric field intensity: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge. **03 Hours**

b. **Electric flux density, Gauss' law and divergence:** Electric flux density, Gauss' law, Divergence, Maxwell's First equation (Electrostatics), vector operator and divergence theorem **04 Hours**

UNIT- 2

a. **Energy and potential:** Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and Potential, The potential field of a point charge and system of charges, Potential gradient, Energy density in an electrostatic field **04 Hours**

b. Conductors, dielectrics and capacitance: Current and current density, continuity of current, metallic conductors, conductor properties and boundary conditions, boundary conditions for perfect dielectrics, capacitance and examples. **03 Hours**

UNIT- 3

Poisson's and Laplace's equations: Derivations of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solutions of Laplace's and Poisson's equations. **06 Hours**

UNIT -4

The steady magnetic field: Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density, scalar and Vector magnetic potentials. **06 Hours**

PART – B

UNIT- 5

a. Magnetic forces: Force on a moving charge and differential current element, Force between differential current elements, Force and torque on a closed circuit.

03 Hours

b. Magnetic materials and inductance: Magnetization and permeability, Magnetic boundary conditions, Magnetic circuit, Potential energy and forces on magnetic materials, Inductance and Mutual Inductance.

04 Hours

UNIT-6

Time varying fields and Maxwell's equations: Faraday's law, displacement current, Maxwell's equation in point and Integral form, retarded potentials.

06 Hours

UNIT- 7

Uniform plane wave: Wave propagation in free space and dielectrics, Poynting's theorem and wave power, propagation in good conductors, skin effect.

07HOURS

UNIT- 8

Plane waves at boundaries and in dispersive media: Reflection of uniform plane waves at normal incidence, SWR, Plane wave propagation in general directions. **06 Hours**

TEXT BOOK:

1. **Engineering Electromagnetics,** William H Hayt Jr. and John A Buck**,** Tata McGraw-Hill, 7th edition, 2009.
2. **Principles of Electromagnetics,** Matthew N.O. Sadiku, 4th Edition, Oxford University Press, 2009.

REFERENCE BOOKS:

1. **Electromagnetics with Applications,** John Krauss and Daniel A Fleisch, McGraw-Hill, 5th edition, 1999.
2. **Electromagnetism-Theory and Applications,** Ashutosh Pramanik, PHI, 2nd edition,Reprint 2009.
3. **Field and Wave Electromagnetics**, David K Cheng, Pearson Education Asia, 2nd edition, - 1989, Indian Reprint – 2001.

10EE45 POWER ELECTRONICS

Subject Code	:	10EE45	IA Marks	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART – A

UNIT 1:

Power Semiconductor Devices:

Introduction to semiconductors, Power Electronics, Power semiconductor devices, Control Characteristics. Types of power electronic converters and industrial applications-Drives, Electrolysis, Heating, Welding, Static Compensators, SMPS, HVDC power transmission, Thyristorized tap changers and Circuit breakers.

7 hours

UNIT 2:

Power Transistors: Power BJT's **–** switching characteristics, switching limits, base drive control. Power MOSFET's and IGBT's –characteristics, gate drive , di/dt and dv/dt limitations. Isolation of gate and base drives. Simple design of gate and base drives. **6 Hours**

UNIT 3:

Thyristors

Introduction, Two Transistor Model, characteristics-static and dynamic. di/dt and dv/dt protection. Ratings of thyristors. Thyristor types. Series and parallel operation of Thyristors. Thyristor firing circuits. Design of firing circuits using UJT, R, R-C circuits. Analysis of firing circuits using operational amplifiers and digital IC's. **7 Hours**

UNIT 4:

Commutation Techniques: Introduction. Natural Commutation. Forced commutation- self-commutation, impulse commutation, resonant pulse commutation and complementary commutation. **6 Hours**

PART – B

UNIT 5:

Controlled Rectifiers: Introduction. Principle of phase controlled converter operation. Single- phase semi-converters. Full converters. Three-phase half-wave converters. Three-phase full-wave converters. **7 Hours**

UNIT 6:

Choppers: Introduction. Principle of step-down and step-up chopper with R-L load. Performance parameters. Chopper classification. Analysis of impulse commutated thyristor chopper (only qualitative analysis) **6 Hours**

UNIT 7:

Inverters: Introduction. Principle of operation. Performance parameters. Single-phase bridge inverters. Threephase inverters. Voltage control of single-phase inverters – single pulse width, multiple pulse width, and sinusoidal pulse width modulation. Current source inverters. **7 Hours**

1

UNIT 8:

(a)AC Voltage Controllers: Introduction. Principle of ON-OFF and phase control. Single-phase, bi-directional controllers with resistive and R-L loads.

(b) Electromagnetic Compatibility: Introduction, effect of power electronic converters and remedial measures.

6 Hours

Text Book:

1. **Power Electronics,** M.H.Rashid, , Pearson, 3rd Edition, 2006.

2. **Power Electronics,** M.D. Singh and Khanchandani K.B., T.M.H., 2nd Edition,2001

References

1. **Power Electronics Essentials and Applications**,L.Umanand, Wiley India Pvt Ltd,Reprint,2010
2. **Thyristorised Power Controllers,** G.K. Dubey, S.R. Doradla, A. Joshi and R.M.K. Sinha, New Age International Publishers.
3. **Power Electronics – Converters, Applications and Design,** Ned Mohan, Tore M. Undeland, and William P. Robins, Third Edition, John Wiley and Sons,2008.
4. **Power Electronics: A Simplified Approach,** R.S. Ananda Murthy and V. Nattarasu, pearson/Sanguine Technical Publishers.

10EE46 TRANSFORMERS AND INDUCTION MACHINES

Subject Code	:	**10EE46**	**IA Marks**	:	25
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	52	Exam Marks	:	100

PART – A

UNIT 1:

Basic Concepts: Principle of operation of transformer, Constructional details of shell type and core type single-phase and three-phase transformers. EMF equation, operation of practical power transformer under

no load and on load (with phasor diagrams).Concept of ideal transformers, current inrush in transformers. **6 Hours**

UNIT 2:

Single-phase Transformers: Equivalent circuit, losses, efficiency, condition for maximum efficiency, all day efficiency. Open circuit and Short circuit tests, calculation of parameters of equivalent circuit. Regulation, predetermination of efficiency and regulation. Polarity test, Sumpner's test.

6 Hours

UNIT 3:

Parallel operation - need, conditions to be satisfied for parallel operation. Load sharing in case of similar and dissimilar transformers. Auto-transformers, copper economy. Brief discussion on constant voltage transformer, constant current transformer. **6 Hours**

UNIT 4:

Three-phase Transformers: Introduction, choice between single unit three-phase transformer and bank of single-phase transformers. Transformer connection for three phase operation – star/star,delta/delta,star/delta,zigzag/star and vee/vee,choice of connection. Phase conversion - Scott connection for three-phase to two-phase conversion. Labeling of three-phase transformer terminals, phase shift between primary and secondary and vector groups. Conditions for parallel operation of three-phase transformers,load sharing. Equivalent circuit of three-phase transformer. **8 Hours**

PART – B

UNIT 5:

Basic Concepts of three phase Induction Machines: Concept of rotating magnetic field. Principle of operation, construction, classification and types - single-phase, three-phase, squirrel-cage, slip-ring. Slip, torque, torque-slip characteristic covering motoring, generating and braking regions of operation. Maximum torque**.** **7 Hours**

UNIT 6:

Three-phase Induction Motor: Phasor diagram of induction motor on no-load and on load. equivalent circuit Losses, efficiency, No-load and blocked rotor tests. Circle diagram and performance evaluation of the motor. Cogging and crawling. **6Hours**

UNIT 7:

High torque rotors-double cage and deep rotor bars.Equivalent circuit and performance evaluation of double cage induction motor. Induction generator – externally excited and self excited. Importance of induction generators in windmills. **6 Hours**

UNIT 8:

(a) Starting and speed Control of Three-phase Induction Motors: Need for starter. Direct on line (DOL), Star-Delta and autotransformer starting. Rotor resistance starting. Soft(electronic) starters. Speed control - voltage, frequency, and rotor resistance. **4 Hours**

(b) Single-phase Induction Motor: Double revolving field theory and principle of operation. Types of single-phase induction motors: split-phase, capacitor start, shaded pole motors. Applications. **3 Hours**

Text Books

1. **Electric Machines,** I. J. Nagrath and D. P. Kothari, T.M.H,4th Edition,2010.
2. **Electric Machines,** Mulukuntla S.Sarma, Mukesh K.Pathak, Cengage Learing,First edition,2009.

References

1. **Performance and Design of A.C. Machines,** M. G. Say,C.B.S. Publishers, 3rd Edition,2002.
2. **Theory of Alternating Current Machines,** Alexander Langsdorf, T.M.H, 2nd edition,2001..
3. **Electrical Machines and Transformers,** Kosow, Pearson, 2nd edition, 2007.
4. **Transformers,** BHEL, TMH,2nd Edition, Eight reprint 2008.

MICROCONTROLLERS LAB

(Common to EC/TC/EE/IT/BM/ML)

Sub Code	**:**	**10ESL47**	***IA Marks***	**:**	**25**
Hrs/ Week	**:**	**03**	Exam Hours	**:**	**03**
Total Hrs.	**:**	**42**	**Exam Marks**	**:**	**50**

I. PROGRAMMING

1. Data Transfer - Block move, Exchange, Sorting, Finding largest element in an array.
2. Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube – (16 bits Arithmetic operations – bit addressable).
3. Counters.
4. Boolean & Logical Instructions (Bit manipulations).

5. Conditional CALL & RETURN.

6. Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX .

7. Programs to generate delay, Programs using serial port and on-Chip timer / counter.

Note: Programming exercise is to be done on both 8051 & MSP430.

II. INTERFACING:

Write C programs to interface 8051 chip to Interfacing modules to develop single chip solutions.

8. Simple Calculator using 6 digit seven segment displays and Hex Keyboard interface to 8051.

9. Alphanumeric LCD panel and Hex keypad input interface to 8051.

10. External ADC and Temperature control interface to 8051.

11. Generate different waveforms Sine, Square, Triangular, Ramp etc. using DAC interface to 8051; change the frequency and amplitude.
12. Stepper and DC motor control interface to 8051.
13. Elevator interface to 8051.

10EEL48 POWER ELECTRONICS LAB

Subject Code	:	**10EEL48**	**IA Marks**	:	25

No. of Practical Hrs./ Week	:	03	Exam Hours	:	03
Total No. of Practical Hrs.	:	42	Exam Marks	:	50

1. Static characteristics of SCR.
2. Static characteristics of MOSFET and IGBT.
3. SCR turn-on circuit using synchronized UJT relaxation oscillator.
4. SCR Digital triggering circuit for a single-phase controlled rectifier and A.C. voltage controller.
5. Single-phase controlled full-wave rectifier with *R* and *R-L* loads.
6. A.C. voltage controller using TRIAC and DIAC combination connected to *R* and *R-L* loads.
7. Speed control of a separately excited D.C. motor using an IGBT or MOSFET chopper.
8. Speed control of D.C. motor using single semi converter
9. Speed control of a stepper motor.
10. Speed control of universal motor using A.C. voltage controller.
11. MOSFET OR IGBT based single-phase full-bridge inverter connected to R load.
12. Study of commutation using LC circuits and auxiliary circuits.

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