

SRM University
M.Tech Automotive Hybrid Systems Engineering
 (Collaborative program with NFTDC, Hyderabad)
 (Proposed syllabus from the academic year 2015-16)

Supportive courses

		L	T	P	C
AH 2191	Digital Electronics and Networks	3	0	0	3
	(Mandatory for mechanical engineering & allied disciplines)				
	Total Contact Hours-45				
	Prerequisites				
	Nil				
PURPOSE					
To incorporate basic skill sets in Passive Electrical Circuits, Network reduction techniques, Network Theorems, Response of RL, RC, RLC circuits to DC excitation, Semiconductor devices, Analog Circuits, Digital Circuits, Mixed Circuits.					

Passive Electrical circuits:

(4 hours)

Ideal Voltage and Current Sources, voltage – current relationship in R, L, C components of Electrical circuits, Ohms Law, Energy stored in Inductor and Capacitor, Kirchoffs Voltage and current laws, Review of Networks and Circuits, Elemental laws ($v-i$ characteristics) for Resistors, Inductors, and Capacitors, Circuitual laws (Kirchhoff laws), Sign convention, Basic signals (dc and ac), Elementary signals (impulse, step, ramp, exponential), Synthesis of arbitrary waveforms (rectangular, triangular etc.) from elementary signals, Voltage and Current sources (Independent and Dependent), Ladder and Bridge Circuits.

Network reduction Techniques:

(2 hours)

Reduction of Series, parallel, series - parallel circuits, star to delta or delta to star transformations;

Network Theorems:

(2 hours)

Thevenin's Theorem, Norton's Theorem, Super position Theorem, Maximum Power Transfer Theorem

Response of RL , RC, RLC circuits to DC Excitation:

(2 hours)

Transient response, steady state response to step input, Time constant, Damping factor; Transients with Energy Storage Elements, First and Second Order Circuits – Time-constant, Damping Ratio, Natural Frequency, Emphasis on Linear Ordinary Differential Equations, Step response of RC, RL, and RLC (series and parallel) Circuits, Resonance in Second Order Circuits.

Semiconductor Devices:

(6 hours)

Characteristics of Diodes, Zener Diodes, BJTs, MOSFETs, IGBTs, SCR, Triac, Solid state Relays

Analog Circuits

(8 hours)

Operational amplifier, Inverting, Non-inverting amplifiers, Summing amplifier, Difference amplifier, Instrumentation Amplifier, Comparator, 555 timer IC, 556 function generator IC, Active Filters (LPF, HPF, Band Pass); Rectifier circuits- Filter circuits-Zener voltage regulator-Biasing BJT, FET MOS FET amplifiers Small signal and high frequency model of BJT, FET & MOS FET Single stage BJT, FET and MOSFET amplifiers with and without active loads -

Source follower Emitter follower Multistage amplifiers- Differential amplifiers- CMRR Advantages of negative feedback- Four basic feedback configurations-Basic principle of oscillators- RC oscillators Power amplifier -class A , Class B, Class AB & class C

Digital Circuits: (8 hours)

Number systems (Binary, Octal, Hexa Decimal representation), Logic Gates, Flip-Flops, counter circuits, Memory Circuits(RAM, EPROM, FLASH); Number systems, BCD codes and arithmetic, Gray codes, self-complementing codes, Error detection and correction principles. Boolean functions using Karnaugh map, Design of combinational circuits, Design of arithmetic circuits. Design of Code converters, Encoders and decoders.

Mixed Circuits: (8 hours)

Multiplexers, De-Multiplexers, Sample & Hold amplifiers, A/D converters, D/A Converters, Three terminal linear Regulators, DC to DC Converters (Buck, Boost)

Linear Integrated Circuits: (5 hours)

Op-amp model- characteristics- analysis op-amp circuits – Instrumentation amplifier- V/I &I/V converter- Transducer bridge amplifier Analysis and design of First order and second order filter circuits and Oscillator circuits Schmitt triggers- A/D &D/A converter- Sample and hold amplifiers - V/F &F/V converter Log amplifier- Multivibrators- Realization of PID Controller, Lead compensator, Lag compensator, Analog multiplier- 555 Timer and its application, voltage regulators. Principles and description of individual blocks of PLL and its application.

References:

1. Edminister J.A., “*Theory and Problems of Electric Circuits*”, Schaum’s Outline Series, McGraw Hill Book Company, 6th Edition, 2014
2. Sudhakar, A. and Shyam Mohan S.P, “*Circuits and Networks Analysis and Synthesis*”, Fourth Edition Tata McGraw Hill Publishing Company Ltd., New Delhi, 2010.
3. Robert .L.Boylsted,and Louis Nashelsky, “*Electronic Devices and Circuit Theory*”, Pearson Education,9th edition,2009.
4. David A Bell, “*Fundamentals of Electronic Devices and Circuits*”, xfordUniversity Press, 2009.
5. Roy Choudhury and Shail Jain, “*Linear Integrated Circuits*”, 2nd Edition, New Age International Publishers, 2003.
6. S.Salivahanan and V.S. Kanchana Bhaaskaran, “*Linear Integrated Circuits*”, 6th Edition, Tata McGraw-Hill, 2011.
7. Morris. M. Mano and Michael.D.Ciletti, “*Digital Design*”, Fourth edition, Pearson Education, 2008.
8. Floyd and Jain, “*Digital Fundamentals*”, Eighth edition, Pearson Education, 2003.
9. Sedha.R.S, “*A Text Book of Applied Electronics*”, Sultan Chand Publishers, 2008.