Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD
Ph.D. Entrance Test 2020
Syllabus of Paper II

Subject: Electronics Engineering

Sr. No.	Name of The Unit	Detailing
01	**Research Methodology**	**Research and Types of research**: Meaning of Research- Objectives of Research- Motivation in Research. Research methods vs Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical. Research Process. Criteria of good Research. **Research Formulation** – Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Literature review – Primary and secondary sources – reviews, treatise, monographs-patents – web as a source – searching the web - Critical literature review – Identifying gap areas from literature review - Development of working hypothesis. **Data Collection and analysis**: Execution of the research - Observation and Collection of data - Methods of data collection – Modeling, Mathematical Models for research, Sampling Methods- Data Processing and Analysis strategies. Data Analysis with Statistical Packages – Hypothesis-testing. Different tools of analysis.
02	**Networks and Electronics Devices**	**Networks**: Network theorems: superposition, Thevenin and Norton's, maximum power transfer; Wye Delta transformation, nodal and mesh analysis Steady state sinusoidal analysis using phasors. Time domain analysis of simple linear circuits Linear constant coefficient differential equations; Frequency domain analysis of RLC circuits; Linear 2-port network parameters: driving point and transfer functions; State equations for networks, Network graphs: matrices associated with graphs; incidence, fundamental cut set and fundamental circuit matrices. **Electronic Devices**: P-N junction, Zener diode, SCR,BJT,IGBT, , MOSFET,LED, photo diode and solar cell; Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS process. Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity drivers, protection ckt, thermal aspects – ratings.
03	**Analog and Digital Circuits**	**Analog Circuits**: Simple diode circuits: clipping, clamping and rectifiers; Single-stage BJT and MOSFET amplifiers: biasing, bias stability, mid frequency small signal analysis and frequency response; BJT and MOSFET amplifiers: multi-stage, differential, feedback, power and operational; Simple op-amp circuits; Active filters; Sinusoidal oscillators: criterion for oscillation, single-transistor and op- amp configurations; Function generators, wave-shaping circuits and 555 timers; Voltage reference circuits; Power supplies: ripple removal and regulation, chopper, inverters. **Digital Circuits**: Number systems; Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates

		and their static CMOS implementations, digital IC families (DTL, TTL,ECL, MOS, CMOS), arithmetic circuits, code converters, multiplexers, decoders and PLAs; Sequential circuits: latches and flip-flops, counters, shift registers and finite state machines; **Data converters**: sample and hold circuits, ADCs and DACs;Semiconductor memories: ROM, SRAM, DRAM; 8/16-bit **microprocessor and microcontroller** (8085/8051/8086/): architecture, programming, memory and I/O interfacing. 16-bit/32-bit ARM7TDMI.
04	**Signals and Systems**	**Signals and systems**, Definitions and properties of Laplace transform, continuous-time and discrete-time Fourier series, Continuous-time and discrete-time Fourier Transform, DFT and FFT, z-transform. Sampling theorem. Linear Time-Invariant (LTI) Systems: definitions and properties; causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay. Signal transmission through LTI systems. **Digital Filters Design**-FIR,IIR,Design by the Bilinear Transformation-Butterworth Filters – Chebyshev Filters – Inverse Chebyshev filters – Elliptic Filters – Frequency transformation Estimation of spectra from Finite Duration Observations signals – Non-parametric methods for power spectrum Estimation – parametric method for power spectrum Estimation. **Image** : Basics attributes of image, Image acquisition, Segmentation, enhancement compression, Morphological operation, **Control System**: Basic control system components; block diagrammatic description, reduction of block diagrams. Open loop and closed loop (feedback) systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems; root loci, Routh-Hurwitz criterion, Bode and Nyquist plots. Control system compensators: elements of lead and lag compensation, elements of Proportional-Integral-Derivative (PID) control. State variable representation and solution of state equation of LTI control
05	**Communications**	**Random signals and noise**: probability, random variables, probability density function, autocorrelation, power spectral density. **Analog communication systems**: amplitude and angle modulations and demodulation systems, spectral analysis of these operations, super heterodyne receivers; elements of hardware, realizations of analog communication systems; signal-to-noise ratio (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) for low noise conditions. Fundamentals of information theory and channel capacity theorem. **Digital communication systems**: PCM, DPCM, ASK, PSK, FSK, matched filter receivers, bandwidth consideration and probability of error calculations for these schemes. Basics of TDMA, FDMA and CDMA and GSM **Wireless & Mobile Communication**: Evolution of 2G,3G,4G ,Bluetooth, Cellular Concept in frequency reuse & Capacity ,Mobile radio Propagation, Wireless Network concept, Traffic Routing

		Satellite fundaments. Satellite link design: Design of down links, uplink design, design of satellite links for specified (C/N) Interference effects in complete link design
		Antennas: antenna types, radiation pattern, gain and directivity, return loss, antenna arrays; Basics of radar; Light propagation in optical fibers.
		Maxwell's equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector; Plane waves and properties: reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth; Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, Sparameters, Smith chart; Waveguides: modes, boundary conditions, cut-off frequencies, dispersion relations

Reference Books:

Unit 01:
1) Mc Buray D.H. Research Methodology Friends Publications New Delhi. 5th Education
2) Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
3) Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
4) Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes

Unit 02:
1) Networks and Systems, Asfaq Hussain, Khanna Publishing House, Delhi
2) Circuits and Network, Sudhakar & Shyammohan, Tata McGraw-Hill
3) Networks and systems, D. Roy Choudhary, New Age International Publishers
4) Solid State Electronic Devices, G. Streetman, and S. K. Banerjee, Pearson
5) Semiconductor Physics and Devices, D. Neamen, D. Biswas, McGraw Hill
6) All-in-One Electronic Simplified, A.K. Maini, Khanna Publishing House
7) Modern Power Electronics, P.C. Sen, Chand & Co.
8) Power Electronics, V.R.Moorthi, Oxford University Press

Unit 03:
1) Analog Electronics, A.K. Maini, Khanna Publishing House
2) Analog Electronics, I.G. Nagrath, PHI
3) Modern Digital Electronics, RP Jain, TMH
4) Digital System Design using VHDL, R. Anand, Khanna Publishing House
5). A VHDL Primer, Bhaskar, Pearson
6) R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing
7) Microprossers and Microcontrollers, Krishna Kant, PHI 3.

8) 8051 Microcontrollers, Rajakamal, TMH

Unit 04:
1) Signals and Systems, A. Anand Kumar, Phi
2) Signals and Systems, Rishabh Anand, Khanna Book Publishing Co., Delhi
3) Signal Processing and Linear Systems, B.P. Lathi, Oxford University Press
4) Signals and Systems, J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, TMH
5) Digital Signal Processing, S. Salivahanan, McGraw Hill
6) Digital Signal Processing, S.K. Mitra, TMH
7) Control Systems, Gopal, Tata McGraw-Hill
8) Modern Control Engineering, Nagrath & Gopal, New Age International

Unit 05:
1) Analog & Digital Communication, B.P. Lathi, Gupta, Oxford University Press
2) Analog & Digital Communications, Debajani Mitra, TMH
3) Integrated Optics, T. Tamir, Springer-Verlag,
4) Nonlinear Fiber Optics, G. Agrawal, Academic Press
5) Fiber optic Communication Systems, G. Agrawal, Wiley India
6) Micro Strip Antennas, J. Bahl and P. Bhartia, Artech House
7) Electromagnetic Waves, R.K. Shevgaonkar, Tata McGraw Hill
8) Electromagnetic Waves, R.L. Yadav, Khanna Publishing House
9) Electromagnetic Waves, R.L. Yadav, Khanna Publishing House
10) Electromagnetic Waves, R.K. Shevgaonkar, Tata McGraw Hill India

Name & Signatures of Syllabus Committee:

Dr.Ulhas Shiurkar   Dr.A.S.Bhalchandra   Dr.Ganesh Sable

(Chairman)   **(Member)**   **(Member)**

Date: 07/06/2020
Place: Aurangabad