Theme Paper on Revision of Syllabi of Electronic Science

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Introduction:

Electronics has been growing exponentially in terms of new technologies, ideas, principles and applications. Electronic Science is concerned with understanding, designing, implementing and using systems, ranging in complexity from simple electronic components, via integrated circuits to information networks as vast as the World Wide Web. It also concerns the practical techniques of creating and handling versatile and improved implements, such as embedded systems and various intelligent networked appliances interfaced though wireless communication devices.

It is very important to understand how to exploit the electronic circuitry for peak efficiency, and explore the possibilities for better hardware platforms including Nano-electronic, molecular electronic, bio-electronic, photonic and quantum computing devices and circuits. This intellectually challenging subject underpins the core technologies of the 21st century, and can be a route to many different career paths. The boundaries of electronic science extend from basic physics, chemistry, mathematics, statistics, computer science, to applied subjects like telecommunications, industrial automation, biotechnology etc. In true sense it is a multidisciplinary subject, which has a unique, well crafted role to play as a bridge between the basic sciences, applied sciences and technological disciplines.

Overview of present syllabi:

Six Categories of courses are covered under Electronic Science discipline

S.No.	Category	Status
1	First Year to Third Year B.Sc. and First and Second Year M.Sc. Electronic Science	Recent revision of syllabus between 2001-2005, Minor corrections in 2006
2	M.Sc. Electronic Science (Credit System)	Recent revision of syllabus in 2004, Updating of individual credit courses done from time to time
3	M. Tech. (VLSI/ Embedded System Design) I	Instituted in 2006, Preparing to get started
4	Fist year and Second Year B.Sc.(Computer Science) Electronic Science courses	Recent Revision in 2002-03, Minor corrections in 2006
5	Post graduate Certificate and Diploma Courses, Certificate courses (after 12^{th})	Introduced in 2000, Revision due
6	Co-curricular Certificate, Diploma and Advanced Diploma Courses	Introduced in 2006

Realizing the growing importance of electronic science, the present syllabi of first year of Bachelor's degree to the last year of post graduate degree were meticulously drafted during 2000-2005, with involvement of majority of stake holders and following a top down approach, i.e. identifying the projected on-job requirements after graduation and then organizing them in hierarchical manner with fundamentals at the first year level and becoming more application oriented and advanced for subsequent years. The

present syllabi designed are on par, in content and scope, with electrical engineering syllabi of IITs in the country and various other contemporary leading institutions across the globe.

The Post graduate certificate and diploma courses, designed as value added courses as an interface between the formal education and industrial need, are conducted jointly by the University department of electronic science and private companies to provide relevant training. These have been instrumental in enhancing job potential.

The exponential growth in the electronic technologies has an implication of high rate of obsolescence, thus raising a pressing demand for updating the syllabi.

Objectives:

1. To design the syllabus with specific focus on Key Learning Areas.
2. To equip student with necessary fundamental concepts and knowledge base.
3. To develop specific practical skills.
4. To impart training on circuit design, analysis, building and testing
5. To develop specialists in hardware – software co-design for application specific electronic systems.
6. To prepare students for demonstrating the acquired knowledge through practical applications in specific projects
7. To encourage student to develop skills for accepting challenges of upcoming technological advancements.
8. To provide job / entrepreneurship development orientation.

Guidelines and Approaches:

Syllabus design is concerned with the **Selection, Sequencing and Justification** of the content of the curriculum. The syllabus should be evolved following a learner centered approach.

1. First year B.Sc. syllabus should focus on basics including information of devices and components, circuit theorems, principles of analog and digital electronics etc.
2. Second year B.Sc. syllabus should provide core technical skills in design, analysis, building and testing of electronic blocks / circuits. Training on equipment handling and maintenance should be included.
3. Third year B.Sc. syllabus should provide exposure to the multiple facets of electronics in the application world. The Key Learning areas at this level include system design and integration right from component selection including sensors, actuators and interfacing devices, programming skills, ECAD and related simulation tools, firm foundations of select advanced subjects and entrepreneurial requisites, and soft skills. Attention must also be given on cultivating attitude for enquiry and analysis.
4. The syllabus at F.Y. B.Sc.(Computer science) should be almost similar to that of the F.Y. B.Sc. Electronic Science, with appropriate corrections in approach and scope
5. The syllabus at S.Y. B.Sc.(Computer Science) should contain a proper blend of core theoretical concepts of Microprocessor architecture and assembly language programming, with introduction to microcontrollers, principles of communication systems and applications in the fields like embedded systems, digital signal processing and satellite communication

Following table shows the Focus areas and target skills for undergraduate

Class	Theory	Practical skills
FYBSc	Focus on Key topics 1. Electronic components 2. Semiconductor devices 3. Circuits and circuit theorems 4. Circuit building tools and techniques 5. Basic measuring instruments (meters & bridges) 6. Basic digital electronics	1. Identification of components 2. Measurements of V and I (DC) 3. Measurements of AC–frequency, phase 4. Timing measurements 5. I/V characteristics 6. Frequency response plots 7. Use of simple graphs, semilog graph 8. Use of electronic instruments 9. Circuit building techniques (breadboard) 10. Soldering on General Purpose Boards
SYBSc	Focus on Key topics 1. Analog circuit design 2. Test & Measuring instruments – Power Supplies, Signal/ Function Generators, CRO…. 3. Digital circuit design 4. Digital Instruments –DMM, DFM, Data loggers, DSO …	1. Layout and artwork preparation 2. PCB making process 3. CAD for PCB making 4. Circuit design and analysis 5. Selection of components 6. Building circuits as per design specs 7. Extensive use of T & M instruments 8. Study of consumer product specs 9. Market survey of e-products 10. Analog / Digital circuit Design
TYBSc	Focus on Key topics 1. Analog communication system 2. Digital communication system 3. Linear IC applications 4. Power Electronics 5. Computer Architecture 6. Digital design using VHDL 7. Microcontrollers 8. Algorithm design and programming in C 9. Semiconductor Science and Technology 10. Applications of Electrostatics & Magnetostatics 11. Sensors and actuators 12. Consumer Electronics	1. Preparing PCBs 2. Circuit building & troubleshooting 3. Circuit tracing 4. Reverse engineering –block diagram preparation 5. Reading datasheets and manuals 6. Instrument design –ergonomics 7. Wiring and harnessing techniques 8. Cables and connectors selections 9. Fault finding and troubleshooting 10. Logic design and analysis 11. Data acquisition techniques 12. Signal/Data processing & analysis 13. Data transmission (telemetry) 14. Programming techniques 15. Efficient algorithm design 16. Assembly and higher level language programming 17. Microcontroller based applications 18. Use of MATLAB 19. Circuit simulation using PSPICE 20. VHDL programming

6. At the post graduation level focus should be on in-depth knowledge and specializations. The research and development approaches must be cultivated with the exposure to the current and futuristic needs of the industry and society at large.

Class	Theory	Practical skills
MSc	1. Data communication & networking 2. Industrial & power electronics 3. Industrial process control 4. Mechatronics & Robotics 5. ASP, DSP and Image processing 6. Embedded system design 7. OS and RTOS 8. Digital design using PLDs 9. Optoelectronics and Optical fiber communication 10. Wireless, Satellite and Microwave communication 11. Electronics for Transportation (Automobiles, Aircraft, Rail) 12. Medical Instrumentation 13. Virtual Instrumentation 14. Scientific Instruments 15. Warfare Systems 16. AI and Neural networks 17. Micro-Electronics / Chip design	1. Design of V/I/Power sources 2. Signal conditioning circuits 3. Signal processing circuits 4. Display/ output systems 5. Power electronic systems 6. Control systems 7. Process control systems 8. Design of intelligent systems 9. Virtual instrument design 10. Signal / data transmission 11. Communication system design 12. Distributed data acquisition 13. Distributed data processing 14. Networking of systems 15. Wireless/ Remote data handling 16. Applications of Electronics – a. Medical field b. R & D labs c. Defense d. Chip design e. Transportation

7. As the aim of the Post graduate certificate and diploma courses is to prepare students for directly becoming suitable for on-site industry jobs, due weightage should be given to incorporate latest industrial trends and technologies in the syllabus with rigorous involvement of practical training.

Re-orientation and the changes required to meet the goals

Supplementary activities for understanding advanced aspects of theory, applications, problem solving, practical applications, various experimentations etc be introduced.

Standard books available by well known authors should be prescribed as text/reference books. The concept of e-learning and e-books should be adopted for promoting self paced study culture.

Review of the National and International level Journal articles and magazines, whichever possible should be made compulsory along with Internet surfing for the current knowledge about the subject.

Examination pattern should be reviewed and appropriate changes should be incorporated, so that the student is assessed in all aspects of learning and provided with proper guidelines, for enabling attainment of the qualities suitable to make an impressive mark in the world after finishing the education.