BITS-Pilani, Hyderabad Campus: Course Description
M.E. Communication Engineering
(Refer: Bulletin pages 204, 212 and 452)

	Semester 1		Semester II	
	Course	Credits	Course	Credits
Year I	EEE G613 Advance Digital Signal Processing	5	BITS G540 Research Practice	4
	EEE G581 RF and Microwave Engineering	5	EEE G592 Mobile and Personal Communication	5
	EEE G612 Coding Theory and Practice	5	EEE G622 Advanced Digital Communication	5
	Elective 1	*	Elective 2	*
		17		17

	Semester 1		Semester II	
	Course	Credits	Course	Credits
Year II	EEE G591 Optical Communication	*	BITS G629T Dissertation	16/20
	Elective 3	*		
	Elective 4	*	BITS G639 Practice School	
	Elective 5	*		
		14		16/20

Core Courses
- EEE G613 Advance Digital Signal Processing
- EEE G581 RF and Microwave Engineering
- EEE G612 Coding Theory and Practice
- EEE G592 Mobile and Personal Communication
- EEE G622 Advanced Digital Communication
- EEE G591 Optical Communication
- BITS G540 Research Practice

Elective Courses (any five)
- BITS F415 Introduction to MEMS
- BITS G553 Real Time Systems
- BITS G554 Data Compression
- CS F303 Computer Networks
- CS F401 Multimedia Computing
- CS F413 Internetworking Technologies
- CS G541 Pervasive Computing
- CS G553 Reconfigurable Computing
- CS G555 Systems Specification and Modeling
- EEE F414 Telecom Switching Systems and Networks
- EEE F472 Satellite Communication
- EEE F474 Antenna Theory and Design
- EEE G510 RF Microelectronics
- EEE G512 Embedded System Design
- EEE G521 Optoelectronic Devices, Circuits and Systems
- EEE G522 Advanced Satellite Communication
- EEE G582 Telecom Network Management
- EEE G626 Hardware Software Co-Design
- EEE G627 Network Embedded Application
- IS F462 Network Programming
- MEL G621 VLSI Design
- MEL G622 Introduction to Artificial Neural networks

Core Courses:

EEE G613 Advanced Digital Signal Processing   [5]

Review of stochastic processes, models and model classification, the identification problem, some field of applications, classical methods of identification of impulse response and transfer function models, model learning techniques, linear least square estimator, minimum variance algorithm, stochastic approximation method and maximum likelihood method, simultaneous state and parameter estimation of extended kalman-filter, non-linear identification, quasi linearization, numerical identification methods.

EEE G581 RF & Microwave Engineering   [3 2 5]

Introduction to radio frequency engineering; advantages; various frequency bands; propagation; transmission lines; microwave waveguides an components; their characterizations; s-parameters and their use; microwave transistor; FETs, Gunn diode, IMPATT diodes; microwave tubes; Klystron; two cavity Klystron amplifier analysis; reflex Klystron; TWTs; high power tubes; cross field tubes; microstrip lines; MMICs; microwave measurements; microwave antennas and microwave communication system; microwave applications; ISM applications; introduction to EMI and EMC; microwave hazards.

EEE G612 Coding Theory & Practice   [3 2 5]

Codes for data-compression: instantaneous codes; Kraft inequality; Mcmillan theorem; Huffman codes; codes for error-detection and correction; binary symmetric channel; channel capacity, Shannon's fundamental theorem; linear codes; Macwilliam's identity; Reed-muller codes; cyclic codes; BCH codes; codes for secrecy and security; private-key cryptosystems; affine codes; twisted codes; one-time-pads; public-key cryptosystems based on large primes and discrete logarithms.

EEE G592 Mobile & Personal Communication   [3 2 5]

History of mobile radio; the mobile radio signal environment; review of statistical techniques; path over flat as well as hilly terrain; effects of RF system design on propagation; received signal envelope and phase characteristics; modulation schemes employed; functional design of mobile radio systems, diversity schemes-space; frequency and polarization diversity; mobile radio system functional design; signal error analysis versus performance criteria; multiple access schemes; classification of the concepts of sensitive topics; new concepts data transmission via cellular; spectrum and technology of WLL

EEE G622 Advanced Digital Communicationp   [3 2 5]

Introduction to Digital communication, review of probability and statistic processes; review of source coding and characterization of signals; optimum receivers for additive white gaussian noise channel; carrier & symbol synchronization; channel capacity & coding; block & convolutional codes; communication through band – limited linear filter channels; adaptive equalization multicarrier systems; digital communication through fading multipath channel; future trends in digital communication

EEE G591 Optical Communication [3 2 5]

Optical communication systems and components optical sources and transmitters (basic concept, design and applications); modulators (electrooptic, acousto-optic and laser modulation techniques); beam forming; focussing and coupling schemes to optical repeaters; optical amplifiers; optical field reception; coherent and non-coherent lightwave systems; fibre optic communication system design and performance; multichannel lightwave systems; long haul communications; fibre optic networks.

BITS G540 Research Practice [4]

This course is designed to train the students towards acquiring competence in research methodologies. The course will be conducted in terms of actual participation in Research and Development Work. Each student will be assigned to a faculty member to work on specified projects. The student will be required to present a number of seminars in his research area in a structured manner.

Electives:

BITS F415 Introduction to MEMS [4*]

Overview, history and industry perspective; working principles; mechanics and dynamics, thermofluid engineering; scaling law; microactuators, microsensors and microelectro mechanical systems; microsystem design, modeling and simulation; materials; packaging; microfabrication: bulk, surface, LIGA etc; micromanufacturing; microfludidics; microrobotics; case studies.

BITS G553 Real Time Systems [5]

Real time software, Real time operating systems scheduling, virtual memory issues and file systems, real time data bases, fault tolerance and exception handling techniques, reliability evaluation, data structures and algorithms for real time/embedded systems, programming languages, compilers and run time environment for real time/embedded systems, real time system design, real time communication and security, real time constraints and multi-processing and distributed systems.

BITS G554 Data Compression [5]

Introduction: the need for data compression. Information theory and data compression; Entropy, Relative entropy and mutual information. Fano's inquality. Types of information sources, and source extension. Asymptotic equipartition property and data compression. Entropy rates of stochastic processes. Kraft inequality, Prefix codes, Huffman codes and Arithmetic coding. Quantization and Rate distortion theory. Lossy image compression techniques based on DCT, VQ and Fractals. Introduction to wavelets: continuous and discrete wavlet transforms. Filter banks and wavelets. Frames and tight frames. Wavelet packets. Wavelet based signal processing. Joint source and channel coding.

CS C461 Computer Networks [3 0 3]

Evolution of communication and computer networks, protocol layering, network reference

models, multiple access protocols, local area networks, packet and circuit switching, switching fabrics, network performance analysis and simulation techniques; addressing, routing, flow and congestion control, IP protocol; Broadband Integrated Services Digital Network (B-ISDN); Asynchronous Transfer Mode (ATM) reference models; network interoperability, traffic management and quality of service in integrated network protocol design and implementation strategies

CS C473 Multimedia Computing [3 0 3]

Introduction to multimedia; media & data streams; image, video & audio file formats; image & video processing, synthesis of sound signal; image coding & compression, video & audio codecs, low rate video telephony; audio-visual integration, lip reading, face animation; augmented reality; multimedia search services, content based image & video indexing; access to multimedia, humanmachine interfaces, spoken language interface; algorithm vs. architecture based approaches, mul timedia processors, performance quantification; case studies, vision 2010.

CS C451 Internetworking Technologies [3 0 3]

Introduction to internetworking concepts; the internet architecture; goals and key issues related to internetworking technologies; design aspects; HTTP and other relevant protocols; agent technology and tools relevant to the internet; techniques of data compression; voice, video, and interactive video- on-demand over the internet; multimedia operating systems and their impact; multimedia networking; mobile computing; internet security; case studies.

CS G541 Pervasive Computing [4]

Select application architectures; hardware aspects; human-machine interfacing; device technology: hardware, operating system issues; software aspects, java; device connectivity issues and protocols; security issues; device management issues and mechanisms; role of web; wap devices and architectures; voice-enabling techniques; PDAs and their operating systems; web application architectures; architectural issues and choices; smart card-based authentication mechanisms; applications; issues and mechanisms in WAP-enabling; access architectures; wearable computing architectures.

CS G553 Reconfigurable Computing [5]

Overview of Programmable Logics. FPGA fabric architectures. Logic Elements and Switch Networks. Design and Synthesis of Combinational and Sequential Elements. Placement and Routing. Pipelining and other Design Methodologies. Fine-grained and Coarse-Grained FPGAs. Static and Dynamic Reconfiguration. Partitioning. Hardware/Software Portioning and Partial Evaluation. Systolic Architectures.

CS G555 System Specifications and Modelling [3 3 4]

Requirement analysis, specification formalisms, system modeling issues, system modeling languages, Hardware Specification and verification languages, EDA tools and its applications.

EEE C414 Telecommunication Switching Systems and Networks [3 0 3]

Intoduction, electromechanical switching, pulse dialing and DTMF dialing, stored program control, space division switching, speech digitization and transmission, time division

switching, fundamentals of traffic engineering, telephone networks, signaling, data networks, layered architecture and protocols, LANs, packet switching networks,TCP/IP, ISDN, ATM networks

EEE F472 Satellite Communication [3 0 3]

Review of microwave communications and LOS systems; the various satellite orbits like GEO, MEO, LEO; the satellite link analysis and design; the communication transponder system like INSAT, INELSAT etc; the earth segment and earth station engineering; the transmission of analog and digital signals through satellite and various modulation techniques employed; the multiple access techniques like FDMA, TDMA, CDMA,DAMA, etc; the INSAT program; salient features of INSAT – systems and services offered; satellite services offered by INTELSAT, INMARSAT and future satellites like IRIDIUM etc; future trends in satellite communications.

EEE F474 Antenna Theory and Design [3 1 4]

Introduction into antenna theory and practice, Radiation integrals and auxiliary potential functions; basic EM theorems in antenna problems, Antenna characteristics, Infinitesimal dipole; wire and loop radiating elements, Wire antennas – dipoles, monopoles, Arrays – analysis and design, Reflector antennas, Broadband antennas, Micro-strip patch antennas, Smith Chart

EEE G510 RF Microelectronics [5]

Introduction; application of RF electronics in modern systems; basic concepts in RF circuit design, active RF components: various RF diodes and transistors and their circuit models, matching and biasing networks, RF amplifier design: low power, low noise and broadband amplifiers, RF oscillator design; negative resistance oscillator; dielectric resonator oscillators, phase noise. RF Mixers: Balanced mixers; low noise mixers; noise in RF circuits, microwave transmitters and receivers.

EEE G512 Embedded System Design [3 1 4]

Introduction to embedded systems; embedded architectures: Architectures and programming of microcontrollers and DSPs. Embedded applications and technologies; power issues in system design; introduction to software and hardware co-design.

EEE G521 Optoelectronic Devices, Circuits & Systems [3 2 5]

Physics of optical radiation and principles of calculation in radiation physics & optics, fundamental laws of photometry. Interaction between optical radiation and matter. Radiation sources. Parameters of IR detectors and junction photodetectors, parameters common to emitters and receiver, radiation measurements, optoelectronic components, optoelectronic integrated devices, photodetector circuits, methods of modulation and optoelectronic system design and applications.

EEE G522 Advanced Satellite Communication [5]

Radio wave propagation effects, low, medium and geo-synchronous earth orbits and their main characteristics. Various sub-systems of the satellite , the outer space and its impact on the design of spacecraft subsystems, LEO satellite network and its routing calls; Battery technology ,

propagation loss models, modulation and error correction techniques, Digital Video Applications, Satellite Mobile including NGEO, satellite access techniques, third generation satellite communication, remote sensing, bandwidth utilization and throughput capability, the Indian National Satellite System (INSAT), INTELSAT and other international satellite programs, VSAT, Mobile and Personal Satellite communication, principles of Global Positioning System (GPS), GPS receivers and its applications

EEE G582 Telecom Network Management   **[5]**

Network architecture and protocols; LAN, MAN and WANs; internetworking; network planning; network management concepts and standards; administrative, operational and fault management; security issues; remote network management.

EEE G626 Hardware Software Co-Design   **[4]**

FPGA and ASIC based design, Low-Power Techniques in RT Embedded Systems On-chip networking. Hardware Software partitioning and scheduling, Co-simulation, synthesis and verifications, Architecture mapping, HW-SW Interfaces and Re-configurable computing.

EEE G627 Network Embedded Applications   **[4]**

This course deals with the three main application areas of Network Embedded Systems – Wireless Sensor Networks, Automotive Networks, and Industrial Networks– Network Architecture, Deployment Issues, Network Protocol stack: Modular and Cross Layer Design. Network Node: Architectures, operating System and Applications. Middleware Issues and Design. Security and Encryption

IS C462 Network Programming   **[3 0 3]**

Overview of computer networks; inter-process communication; network programming; socket interface; client-server computing model: design issues, concurrency in server and clients; external data representation; remote procedure calls; network file systems; distributed systems design

MEL G621 VLSI Design   **[3 2 5]**

Introduction to NMOS and CMOS circuits; NMOS and CMOS processing technology; CMOS circuits and logic design; circuit characterization and performance estimation; structured design and testing; symbolic layout systems; CMOS subsystem design; system case studies.

MEL G622 Introduction to Artificial Neural Networks   **[2 2 4]**

Fundamentals and definitions; Perceptrons, backpropagation and counter propagation Networks; Statistical methods for network training; Hopfield nets; Associative memories; Optical neural networks; Applications of neural networks in speech processing, computer networks and visual processing.