DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, UTTAR PRADESH, LUCKNOW

EVALUATION SCHEME & SYLLABUS

FOR

B. TECH. THIRD YEAR

ELECTRONICS ENGINEERING
ELECTRONICS AND COMMUNICATION ENGINEERING
ELECTRONICS AND TELECOMMUNICATION ENGINEERING

AS PER

AICTE MODEL CURRICULUM

[Effective from the Session: 2020-21]

B.Tech. VI Semester
Electronics and Communication Engineering

S. No.	Course Code	Course Title	Periods			Evaluation Scheme				End Semester		Total	Credits
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KEC-601	Digital Communication	3	1	0	30	20	50		100		150	4
2	KEC-602	Control System	3	1	0	30	20	50		100		150	4
3	KEC-603	Antenna and Wave Propagation	3	1	0	30	20	50		100		150	4
4		Department Elective–III	3	0	0	30	20	50		100		150	3
5		Open Elective-I	3	0	0	30	20	50		100		150	3
6	KEC-651	Digital Communication Lab	0	0	2				25		25	50	1
7	KEC-652	Control System Lab	0	0	2				25		25	50	1
8	KEC-653	Elective Lab	0	0	2				25		25	50	1
9	KNC601/ KNC602	Constitution of India, Law and Engineering / Indian Tradition, Culture and Society	2	0	0	15	10	25		50			NC
10		MOOCs (Essential for Hons. Degree)											
		Total										**900**	**21**

Course Code	Course Title
	Department Elective-III
KEC-061	Microcontroller & Embedded System Design
KEC-062	Satellite Communication
KEC-063	Data Communication Networks
KEC-064	Analog Signal Processing
KEC-065	Random Variables & Stochastic Process

Course Code	Elective Lab
KEC-653A	Measurement & Instrumentation Lab
KEC-653B	Cad for Electronics Lab
KEC-653C	Microcontroller & Embedded System Design Lab

B.Tech 3rd Year
VI Semester
Syllabus

KEC-601	DIGITAL COMMUNICATION	3L:1T:0P	4 Credits

Unit	Topics	Lectures
I	**Random Variables:** Concept of Probability, Random variables, Statistical averages, Random process, Power Spectral Density & Autocorrelation Function of Random Processes, Gaussian Random Process.	8
II	**Digital Communication Basics:** Introduction to Digital communication systems, PSD of Line Coding schemes, Pulse shaping, Scrambling, Eye diagram, Gram-Schmidt orthogonalization scheme.	8
III	**Digital Modulation:** Modulation and Demodulation of Digital modulation schemes-ASK, FSK, PSK, DPSK, QPSK. Constellation diagram, Introduction to M-ary communication.	8
IV	**Digital Receiver:** Optimum threshold detection, Concept of Matched Filters, BER analysis of BASK, BFSK, BPSK, Introduction of Spread spectrum communication (DS-SS, FH-SS).	8
V	**Information Theory:** Measure of information-information, entropy, mutual information, mutual entropy, Source encoding (Shannon-Fano, Huffman), Shannon's channel capacity theorem, Introduction to error correction and detection, Linear block codes, Cyclic codes (systematic, non-systematic), Convolution coding and decoding.	8

Text Books:
1. B.P. Lathi, "Modern Digital and Analog communication Systems", 4th Edition, Oxford University Press.
2. John G. Proakis, "Digital Communications", 5th Edition, TMH.
3. H. Taub, D L Schilling, Gautam Saha, "Principles of Communication", 4th Edition, TMH.
4. Singh & Sapray, Communication Systems, 3th Edition, TMH.

Reference Books:
1. Simon Haykin, "Communication Systems", 5th Edition, Wiley India.
2. (Schaum's Outline Series) H P HSU & D Mitra, "Analog and Digital Communications", TMH, 3rd Edition.

Course Outcomes: At the end of this course students will demonstrate the ability:
1. To formulate basic statistics involved in communication theory.
2. To demonstrate the concepts involved in digital communication.
3. To explain the concepts of digital modulation schemes.
4. To analyze the performance of digital communication systems.
5. To apply the concept of information theory in digital systems.

KEC-602	Control System	3L:1T:0P	4 Credits

Unit	Topics	Lectures
I	**Introduction to Control Systems:** Basic Components of a control system, Feedback and its effect, types of feedback control systems. Block diagrams Reduction and signal flow graphs, Modeling of Physical systems: electrical networks, mechanical systems elements, free body diagram, analogous Systems, sensors and encoders in control systems, modeling of armature controlled and field controlled DC servomotor.	8
II	**State-Variable Analysis:** Introduction, vector matrix representation of state equation, state transition matrix, state-transition equation, relationship between state equations and high-order differential equations, relationship between state equations and transfer functions, Decomposition of transfer functions, Controllability and observability, Eigen Value and Eigen Vector, Diagonalization.	8
III	**Time domain Analysis of Control Systems:** Time response of continuous data systems, typical test signals for the time response of control systems, unit step response and time-domain specifications, time response of a first order system, transient response of a prototype second order system, Steady-State error, Static and dynamic error coefficients, error analysis for different types of systems.	8
IV	**Stability of Linear Control Systems:** Bounded-input bounded-output stability continuous data systems, zero-input and asymptotic stability of continuous data systems, Routh Hurwitz criterion, Root-Locus Technique: Introduction, Properties of the Root Loci, Design aspects of the Root Loci.	8
V	**Frequency Domain Analysis:** Resonant peak and Resonant frequency, Bandwidth of the prototype Second order system, effects of adding a zero to the forward path, effects of adding a pole to the forward path, polar plot, Nyquist stability criterion, stability analysis with the Bode plot, relative stability: gain margin and phase margin.	8

Text Book:
1. I. J. Nagrath & M. Gopal, "Control System Engineering", 6th Ed. New Age International Publishers, 2018
2. B.C. Kuo & Farid Golnaraghi, "Automatic Control Systems", 9th Edition, John Wiley India, 2008

Reference Books:
1. (Schaums Outlines Series) Joseph J. Distefano III, Allen R. Stubberud, Ivan J. Williams, "Control Systems", 3rd Edition, TMH, Special Indian Edition, 2010.
2. A. Anand Kumar, "Control Systems", Second Edition, PHI Learning private limited, 2014.
3. William A. Wolovich, "Automatic Control Systems", Oxford University Press, 2011.

Course Outcomes: At the end of this course students will demonstrate the ability to:
1. Describe the basics of control systems along with different types of feedback and its effect. Additionally they will also be able to explain the techniques such as block diagrams reduction, signal flow graph and modelling of various physical systems along with modelling of DC servomotor.
2. Explain the concept of state variables for the representation of LTI system.
3. Interpret the time domain response analysis for various types of inputs along with the time domain specifications.
4. Distinguish the concepts of absolute and relative stability for continuous data systems along with different methods.
5. Interpret the concept of frequency domain response analysis and their specifications.

KEC-603	Antenna & Wave Propagation	3L:1T:0P	4 Credits

Unit	Topics	Lectures
I	**Coordinate Systems and Transformation:** Cartesian, Cylindrical, Spherical transformation. Vector calculus: Differential length, area and volume, line, surface and volume integrals, Del operator, Gradient, Divergence of a vector, Divergence theorem, Curl of a vector, Stokes's theorem, Laplacian of a scalar.	6
II	**Electrostatic fields and Magnetostatic fields**: Electric field intensity, Electric field due to charge distribution, Electric flux density, Gauss's Law- Maxwell's equation, Continuity equation and relaxation time, boundary conditions, Magneto-static fields, Ampere's circuit law, Maxwell's equation, magnetic scalar and vector potential, Magnetic boundary conditions, Maxwell's equation in final form.	10
III	**Antenna fundamental and definitions:** Introduction, Basic antenna parameters, Patterns, Beam area (or Beam solid angle) ΩA, Radiation intensity, Beam efficiency, Directivity D and Gain G, Directivity and resolution, Antenna apertures, Effective height, The radio communication link, Fields from oscillating dipole, Single-to-noise ratio (SNR), Antenna temperature, Antenna impedance.	8
IV	**Antenna Design:** Electric dipoles, The short electric dipole, The fields of a short dipole, Radiation resistance of short electric dipole, Thin linear antenna, Radiation resistance of $\lambda/2$ antenna, Array of two driven $\lambda/2$ elements: Broadside case and end-fire case, Horizontal antennas above a plane ground, Vertical antennas above a plane ground, Yagi-Uda antenna design, Longwire antennas, Folded dipole antennas.	8
V	**Wave Propagation:** Plane earth reflection, Space wave and surface wave. Space wave propagation: Introduction, Field strength relation, Effects of imperfect earth, Effects of curvature of earth. Sky wave propagation: Introduction structural, details of the ionosphere, Wave propagation mechanism, Refraction and reflection of sky waves by ionosphere, Ray path, Critical frequency, MUF, LUF, OF, Virtual height and skip distance, Relation between MUF and the skip distance, Multi-Hop propagation, Wave characteristics.	8

Text Books:
1. MNO Sadiku, "Elements of Electromagnetic', 7th Ed, Oxford University Press, 2018.
2. John D Kraus, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation", 5th Edition, Tata McGraw Hill, 2017.
3. Das, Antennas and Wave Propagation, TMH 1st Edition.
4. C. A. Balanis, "Antenna Theory Analysis and Design", John Wiley, 2016.
5. WH Hayt and JA Buck, "Engineering Electromagnetic", 7th Edition TMH, 2013.
6. (Schaums Outlines Series) Joseph J. Distefano III, Allen R. Stubberud, Ivan J. Williams, "Engineering Electromagnetic", 3rd Edition, TMH, Special Indian Edition, 2010.

Course Outcomes: At the end of this course students will demonstrate the ability to:
1. Identify different coordinate systems and their applications in electromagnetic field theory to establish a relation between any two systems using the vector calculus.
2. Explain the concept of static electric field, current and properties of conductors.
3. Express the basic concepts of ground, space, sky wave propagation mechanism.
4. Demonstrate the knowledge of antenna fundamentals and radiation mechanism of the antenna.
5. Analyze and design different types of basic antennas.

7.

KEC-062	SATELLITE COMMUNICATION	3L:0T:0P	3 Credits

Unit	Topics	Lectures
I	**Introduction to Satellite Communication:** History, Overview of Satellite Communication, Types of Satellite, Types of Orbit, Satellite services, Advantages & Applications of Satellite communication, Satellite Life phases, Space Debris, Introduction to Geo-synchronous and Geo-stationary satellites.	8
II	**Orbital Mechanics:** Orbital Mechanics, Kepler's Three laws of Planetary Motion, Developing the Equations of the orbit, Look Angle Determination, Earth Stations, Orbital Perturbations, Orbital effects in Communication system performance.	8
III	**Satellite Sub-systems:** Seven segments of Satellite communication, Attitude and Orbit control systems, Telemetry, Tracking and command control system, Power supply system. **Satellite Link Design:** Basic transmission theory, System noise temperature and G/T ratio, Design of down link and uplink, Design of satellite links for specified C/N.	8
IV	**Introduction to Various Satellite Systems:** VSAT, Direct broadcast satellite television and radio, Satellite navigation and the Global positioning systems, GPS position location principle, GPS receivers and codes, Satellite Signal Acquisition, GPS navigation Message, GPS Signal Levels, Timing Accuracy, GPS Receiver Operation.	8
V	**Launchers & Advanced Technologies:** Mechanism of Satellite launching, Launch Vehicles, Advanced launching tech like Space X, Intelligent Testing, Control and Decision making for Space, Inter Satellite Link. **Indian Satellite Systems:** History and Overview of Indian Satellite System, Achievements, GSLV, PSLV, Advanced Technology Vehicle.	8

Text Books:
1. B.Pratt, A.Bostian, "Satellite Communications", Wiley India, 2nd Edition,2006.
2. D. Roddy, "Satellite Communications", TMH, 4th Edition, 2001.
3. Digital Satellite Communications/ Tri T. Ha./ McGraw-Hill, 2nd Edition
4. D.C. Agrawal, Satellite communication, Khanna Publishers; 7th Edition.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Define and list the benefits of satellite communication**.**
2. Demonstrate orbital mechanics principles of satellite communication systems and solve problems related to it.
3. Describe a satellite link and identify ways to improve the link performance.
4. Classify new technologies of satellite communication systems as per given specifications.
5. Examine advanced technologies of satellite launching and describe the Indian satellite system.

ELECTRONICS AND COMMUNICATION ENGINEERING

KEC-651	DIGITAL COMMUNICATION LAB	0L:0T:2P	1 Credit

SUGGESTIVE LIST OF EXPERIMENTS:

Part A
1. To study Eye diagram patterns of various digital pulses.
2. To study the inter symbol interference.
3. To study generation of Unipolar RZ & NRZ Line Coding.
4. To study generation of Polar RZ & NRZ Line Coding.
5. To study generation of Bipolar RZ & NRZ Line Coding.
6. Implementation and analysis of BASK modulation and demodulation
7. Implementation and analysis of BFSK modulation and demodulation
8. Implementation and analysis of BPSK modulation and demodulation. *(Through Virtual Lab)*
9. Implementation and analysis of QPSK modulation and demodulation. *(Through Virtual Lab)*
10. To simulate M-ary Phase shift keying technique using MATLAB.
11. To study generation and detection of DPSK using MATLAB.
12. Implementation and analysis of Delta modulation and demodulation.
13. Implementation and analysis of DSSS Modulation, Demodulation & BER measurement.
14. Implementation and analysis of FHSS Modulation, Demodulation & BER measurement.
15. To study encoding and decoding of Linear Block Codes
16. To study the working of Convolution encoder.

Part B
1. To study simple dipole λ 2 antenna and to calculate beam-width, front / back ratio, and gain of the antenna. 10.
2. To study folded dipole antenna and to calculate beam-width, front / back ratio, and gain of the antenna.
3. To study λ 2 phase array end-fire antenna and to calculate beam-width, front / back ratio, and gain of the antenna.
4. To study broadside array antenna and to calculate beam-width, front / back ratio, and gain of the antenna.

Virtual Lab Link: https://vlab.amrita.edu/?sub=1&brch=201

Course Outcomes: At the end of this course students will demonstrate the ability:
1. To formulate basic concepts of pulse shaping in digital communication.
2. To identify different line coding techniques and demonstrate the concepts.
3. To design equipments related to digital modulation and demodulation schemes.
4. To analyze the performance of various digital communication systems and evaluate the key parameters.
5. To conceptualize error detection & correction using different coding schemes in digital communication.

KEC-652	CONTROL SYSTEM LAB	0L:0T:2P	1 Credit

SUGGESTIVE LIST OF EXPERIMENTS:

1. Introduction to MATLAB Control System Toolbox.
2. Determine transpose, inverse values of given matrix.
3. Plot the pole-zero configuration in s-plane for the given transfer function.
4. Determine the transfer function for given closed loop system in block diagram representation.
5. Create the state space model of a linear continuous system.
6. Determine the State Space representations of the given transfer function.
7. Determine the time response of the given system subjected to any arbitrary input.
8. Plot unit step response of given transfer function and find delay time, rise time, peak time, peak overshoot and settling time.
9. Determine the steady state errors of a given transfer function.
10. Plot root locus of given transfer function, locate closed loop poles for different values of k.
11. Plot bode plot of given transfer function. Also determine gain and phase margins.
12. Plot Nyquist plot for given transfer function. Also determine the relative stability by measuring gain and phase margin.

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Classify different tools in MATLAB along with the basic matrix operations used in MATLAB.

2. Evaluate the poles and zeros on s-plane along with transfer function of a given system.

3. Construct state space model of a linear continuous system.

4. Evaluate the various specifications of time domain response of a given system.

5. Appraise the steady state error of a given transfer function.

6. Examine the relative stability of a given transfer function using various methods such as root locus, Bode plot and Nyquist plot.

KEC-653A	MEASUREMENT & INSTRUMENTATION LAB	0L:0T:2P	1 Credit

SUGGESTIVE LIST OF EXPERIMENTS:

1. Measurement of phase difference and frequency using CRO (Lissajous Figure)
2. Study of L.C.R. Bridge and determination of the value of the given components.
3. Characteristics of Thermocouples and RTD.
4. Study of the following transducer (i) PT-100 Transducer (ii) J-Type Transducer (iii) K-Type Transducer (iv) Pressure Transducer
5. Characteristics of LDR, Photo Diode, and Phototransistor:
    (i) Variable Illumination.
    (ii) Linear Displacement
6. Characteristics of LVDT.
7. Study of the transistor tester and determination of the parameters of the given transistors
8. Experiment using PLC Trainer Kits

Through Virtual Lab:
9. Measurement of low resistance Kelvin's double bridge.
10. To measure unknown capacitance of small capacitors by using Schering's bridge.
11. To measure unknown Inductance using Hay's bridge.
12. Measurement of capacitance by De Sauty Bridge.

Virtual Lab Link: http://vlabs.iitkgp.ernet.in/asnm/#

Available on: http://www.vlab.co.in/broad-area-electronics-and-communications

Course Outcomes:
At the end of this course students will demonstrate the ability to:
1. Measure the unknown resistance, capacitance and inductance using LCR Bridge, Kelvin double bridge, Schering bridge, Hay's bridge, De sauty bridge.
2. Practically demonstrate the different types of transducers like J-type, K-type, PT-100 and RTD.
3. Interpret frequency and phase difference from Lissajous figure.
4. Interpret hybrid parameters of transistor and demonstrate different transducer like LDR and LVDT.
5. Demonstrate Experiment using PLC Trainer Kits

KOE-060   IDEA TO BUSINESS MODEL

Course Objectives:
1. This course can motivate students to have an overall idea how to start and sustain a business enterprise.
2. The students will learn basics of choosing an idea of a business model.
3. The core areas of choosing a business model are encompassed with Entrepreneurship development, PPC & communication system. The students will thus develop basic competencies how to run a business enterprise.

Unit	Topics	Lectures
I	**Introduction** Search for a business idea- How to choose an idea- Product idea- selection of product- The adoption process- Product innovation- Production , planning and development strategy- New product idea.	8
II	Introduction to Entrepreneurship - Meaning and concept of entrepreneurship- Difference between Entrepreneurship & wage employment - Functions of an Entrepreneur.- Entrepreneur vs Manager- role of entrepreneurship in economic development – Barriers to entrepreneurship.	8
III	The Entrepreneur - types of entrepreneurs- Competencies required to become an entrepreneur - Creative and Design Thinking, the entrepreneurial decision process- The process of Entrepreneurial development prog (EDP)- Evaluation of EDP - Entrepreneur development training.	8
IV	Production system- Design of production system- Types of production system- Production, planning & control (PPC) - Steps of PPC.	8
V	Communication- Importance of communication system - barriers to communication - listening to people- the power of talk - personal selling - risk taking & resilience - negotiation.	8

Text Books:
1. Entrepreneurship Development- Sangeeta Sharma, Kindle edition
2. Production & operations Management- Kanishka Bedi,
3. Marketing Management- Philip Kotler.
4. The Business Model Book: Design, build and adapt business ideas that drive business growth: Adam Bock , Gerard George

Course Outcomes: At the end of this course students will demonstrate the ability to:
1. Enhance creative knowledge of students regarding selection of a business idea and it's implementation process.
2. Acquire knowledge on entrepreneurship development, its Pro's and con's.
3. Acquire basic knowledge on how to become an Entrepreneur.
4. Develop knowledge on Production systems and it's sustainability through production, planning and control (PPC)
5. Develop appropriate business model and apply in a better way.

INDIAN TRADITIONS, CULTURAL AND SOCIETY

L: T:P: 2: 0:0

Module 1- Society State and Polity in India

State in Ancient India: Evolutionary Theory, Force Theory, Mystical Theory Contract Theory, Stages of State Formation in Ancient India, Kingship , Council of Ministers Administration Political Ideals in Ancient India Conditions' of the Welfare of Societies, The Seven Limbs of the State, Society in Ancient India, Purusārtha, Varnāshrama System, Āshrama or the Stages of Life, Marriage, Understanding Gender as a social category, The representation of Women in Historical traditions, Challenges faced by Women. Four-class Classification, Slavery.

Module 2- Indian Literature, Culture, Tradition, and Practices

Evolution of script and languages in India: Harappan Script and Brahmi Script. The Vedas, the Upanishads, the Ramayana and the Mahabharata, Puranas, Buddhist And Jain Literature in Pali,Prakrit And Sanskrit, Kautilya's Arthashastra, Famous Sanskrit Authors, Telugu Literature, Kannada Literature,Malayalam Literature ,Sangama Literature Northern Indian Languages & Literature, Persian And Urdu ,Hindi Literature

Module 3- Indian Religion, Philosophy, and Practices

Pre-Vedic and Vedic Religion, Buddhism, Jainism, Six System Indian Philosophy, Shankaracharya, Various Philosophical Doctrines , Other Heterodox Sects, Bhakti Movement, Sufi movement, Socio religious reform movement of 19th century, Modern religious practices.

Module 4-Science, Management and Indian Knowledge System

Astronomy in India, Chemistry in India, Mathematics in India, Physics in India, Agriculture in India, Medicine in India ,Metallurgy in India, Geography, Biology, Harappan Technologies, Water Management in India, Textile Technology in India ,Writing Technology in India Pyrotechnics in India Trade in Ancient India/,India's Dominance up to Pre-colonial Times

Module 5- Cultural Heritage and Performing Arts

Indian Architect, Engineering and Architecture in Ancient India, Sculptures, Seals, coins, Pottery, Puppetry, Dance, Music, Theatre, drama, Painting, Martial Arts Traditions, Fairs and Festivals, Current developments in Arts and Cultural, Indian's Cultural Contribution to the World. Indian Cinema

COURSE OBJECTIVES:

- The course aims at imparting basic principles of thought process, reasoning and inference to identify the roots and details of some of the contemporary issues faced by our nation and try to locate possible solutions to these challenges by digging deep into our past.
- To enable the students to understand the importance of our surroundings and encourage the students to contribute towards sustainable development.
- To sensitize students towards issues related to 'Indian' culture, tradition and its composite character.

- To make students aware of holistic life styles of Yogic-science and wisdom capsules in Sanskrit literature that are important in modern society with rapid technological advancements and societal disruptions.
- To acquaint students with Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.

COURSE OUTCOMES: Ability to understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.

Suggested Pedagogy for Teachers

- Project based learning
- Case studies
- Group discussion
- Presentations

Suggested Text & Reference Books

1. V. Sivaramakrishna (Ed.), *Cultural Heritage of India-Course Material*, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. S. Baliyan, *Indian Art and Culture*, Oxford University Press, India
3. Swami Jitatmanand, *Modern Physics and Vedant*, Bharatiya Vidya Bhavan
4. Romila Thapar, *Readings In Early Indian History* Oxford University Press , India
5. Fritz of Capra, Tao of Physics
6. Fritz of Capra, The wave of Life
7. V N Jha (English Translation), *Tarkasangraha of Annam Bhatta,* Inernational Chinmay Foundation,Velliarnad,Amaku,am
8. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta
9. GN Jha (Eng. Trans.) Ed. R N Jha, *Yoga-darshanam with Vyasa Bhashya*, Vidyanidhi Prakasham, Delhi,2016
10. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016
11. P R Sharma (English translation), Shodashang Hridayam
12. Basham, A.L., *The Wonder that was India* (34th impression), New Delhi, Rupa & co
13. Sharma, R.S., *Aspects of Political Ideas and Institutions in Ancient India*(fourth edition), Delhi, Motilal Banarsidass,