BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ODISHA

ROURKELA

Curriculum and Syllabus

B. Tech (*Electrical and Electronics Engineering*) from the Admission Batch

2018-19

Semester (6th)

Sixth Semester							
Theory							
Sl No	**Category**	**Course Code**	**Course Title**	**L-T-P**	**Credit**	**University Marks**	**Internal Evaluation**
1	PC	REE6C001	Communication Engineering	3-0-0	3	100	50
2	PC		Microprocessor and Micro controllers	3-0-0	3	100	50
3	BS		Optimization in Engineering	3-0-0	3	100	50
4	PE	REL6D001	Power System Operation and Control	3-0-0	3	100	50
		REL6D002	Electric and Hybrid Vehicles				
			Advance Electronics Circuits				
5	OE		Artificial Intelligence and Machine Learning	3-0-0	3	100	50
			Biomedical Instrumentation				
			Computer Organisation and Architecture				
6	MC*	RIK6F001	Essence of Indian Knowledge Tradition - I	3-0-0	0		100 (Pass Mark is 37)
Total Credit (Theory)					**15**		
Total Marks						**500**	**250**
Practical							
1	PC		Communication EngineeringLab	0-0-3	2		100
2	PC		Microprocessor and Micro controllers Lab	0-0-3	2		100
3	PSI		Future-ready Contributor Program	0-0-3	2		100
4	PSI		Seminar - I	0-0-3	1		100
Total Credit (Practical)					**7**		
Total Semester Credit					**22**		
Total Marks							**400**
SUMMER INTERNSHIP TRAINING FOR 45 DAYS							

***Mandatory Non-Credit Courses (MC) result will be reflected with Pass (P) / Fail (F) grade. Thus the grade obtained will not be affecting the grade point average. However it shall appear on the grade sheet as per AICTE rule.**

6th Semester	REE6C001	Communication Engineering	L-T-P 3-0-0	3 Credits

Module I: **(10 Hours)**

Introduction: Elements of an Electrical Communication System, CommunicationChannels and their Characteristics, Mathematical Models for Communication ChannelsFrequency domain analysis of signals and systems: Fourier series,Fourier Transforms, Power and Energy, Sampling and Band limited signals, Band passsignals.

Module II: **(10 Hours)**

Analog signal transmission and reception: Introduction to modulation, Amplitude Modulation (AM), Angle Modulation, Radio and Television broadcasting.

Module III: **(10 Hours)**

Pulse modulation systems: Pulse amplitude modulation, Pulse Time Modulation
Pulse code modulation: PCM system, Intersymbol interference, Eye patterns, Equalization, Companding, Time Division Multiplexing of PCM signals, Line codes, Bandwidth of PCM system, Noise in PCM systems.

Module IV: **(10 Hours)**

Delta Modulation (DM), Limitations of DM, Adaptive Delta Modulation, Noise in Delta Modulation, Comparison between PCM and DM, Delta or Differential PCM (DPCM), S-Ary System.

Books:

[1] John G.Proakis,M. Salehi, Communication Systems Engineering, 2nd ed. New Delhi, India. PHI Learning Private Limited, 2009.
[2] R.P Singh and S.D Sapre, Communication Systems Analog & Digital, 2nd ed. New Delhi, India. Tata McGraw Hill Education Private Limited, 2009.

Digital Learning Resources:

Course Name: Analog Communication
Course Link: https://nptel.ac.in/courses/117/105/117105143/
Course Instructor: Prof. Goutam Das, IIT Kharagpur

6th Semester	REE6C002	Microprocessor and Micro controllers	L-T-P 3-0-0	3 Credits

Module I: **(10 hours)**

Introduction to 8 bit and 16 bit Microprocessors-H/W architecture:
Introduction to microprocessor, computer and its organization, Programming system; Address bus, data bus and control bus, Tristate bus; clock generation; Connecting Microprocessor to I/O devices; Data transfer schemes; Architectural advancements of microprocessors. Introductory System design using microprocessors; 8086 – Hardware Architecture; External memory addressing; Bus cycles; some important Companion Chips; Maximum mode bus cycle; 8086 system configuration; Memory Interfacing; Minimum mode system configuration, Interrupt processing.

Module II: **(8 hours)**
16-bit microprocessor instruction set and assembly language programming:
Programmer's model of 8086; operand types, operand addressing; assembler directives, instruction Set-Data transfer group, Arithmetic group, Logical group.

Module III: **(8 hours)**
Microprocessor peripheral interfacing:
Introduction; Generation of I/O ports; Programmable Peripheral Interface (PPI) - Intel 8255; Sample-and-Hold Circuit and Multiplexer; Keyboard and Display Interface; Keyboard and Display Controller (8279).

Module IV: **(12 hours)**
8-bit microcontroller- H/W architecture instruction set and programming:
Introduction to 8051 Micro-Controllers, Architecture; Memory Organization; Special Function register; Port Operation; Memory Interfacing, I/O Interfacing; Programming 8051 resources, interrupts; Programmer's model of 8051; Operand types, Operand addressing; Data transfer instructions, Arithmetic instructions, Logic instructions, Control transfer instructions; Programming.

Module V: **(10 hours)**
Maximum mode system configuration, Direct memory access, Interfacing of D- to-A converter, A-to-D converter, CRT Terminal Interface, Printer Interface, Programming of 8051 timers, 8051 serial interface. Introduction to 80386 and 80486 Microprocessor family.

Books:
[1] Microprocessor Architecture, Programming and application with 8085, R.S. Gaonkar, PRI Penram International publishing PVT. Ltd., 5th Edition .
[2] Microprocessors and Interfacing, Programming and Hardware, Douglas V Hall, TMH Publication, 2006.
[3] Microprocessors and Interfacing, N. Senthil Kumar, M. Saravanan, S. Jeevananthan
[4] The 8051 Microcontroller and Embedded Systems, Muhammad Ali Mazidi, Janice GillispieMazidi, Rolin D.M C Kinlay, Pearson Education, Second Edition, 2008.
[5] Microcontrollers: Principles and Application, Ajit Pal, PHI Publication.
[6] Microprocessors and Microcontrollers Architecture, programming and system design using 8085, 8086, 8051 and 8096, Krishna Kant, PHI Publication, 2007.
[7] Advanced Microprocessors and Peripherals, A.K. Ray, K M Bhurchandi, TMH Publication, 2007.
[8] Textbook of Microprocessor and Microcontroller, Thyagarajan, Scitech Publication.

Digital Learning Resources:

6th Semester		Optimization in Engineering	L-T-P 3-0-0	3 Credits

Course Name: Microcontrollers and Applications
Course Link: https://nptel.ac.in/courses/117/104/117104072/
Course Instructor: Prof. S. P Das, IIT Kanpur

Module I: **(10 Hours)**

Idea of Engineering optimization problems, Classification of optimizationalgorithms, modeling of problems and principle of modeling. Linear Programming:Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method , Sensitivity analysis in linear programming.

Module II: **(10 Hours)**

Transportation problems:Finding an initial basic feasible solution by NorthwestCorner rule, Least Cost rule, Vogel's approximation method, Degeneracy, Optimalitytest, MODI method, Stepping stone method. **Assignment problems:** Hungarian method for solution of Assignment problems. Integer Programming: Branch and Bound algorithm for solution of integer programming problems.

Module III: **(12 Hours)**

Non-linear programming: Introduction to non-linear programming. Unconstraintoptimization: Fibonacci and Golden Section Search method. Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method. Constrained optimization with inequality constraint: Kuhn-Tucker condition, Quadratic programming.

Module IV: **(6 Hours)**

Queuing models: General characteristics, Markovian queuing model, M/M/1model, Limited queue capacity, multiple server, Finite sources, Queue discipline.

Books:

[1] Operations Research- Principle and Practice, A. Ravindran, D. T. Philips, J. Solberg, Second edition, Wiley India Pvt Ltd.
[2] Operation Research, Prabhakar Pai ,Oxford University Press
[3] Optimization for Engineering Design, Kalyanmoy Deb, PHI Learning Pvt Ltd.
[4] Operations Research, H.A.Taha, A.M.Natarajan, P.Balasubramanie, A.Tamilarasi, Pearson Education, Eighth Edition.
[5] Engineering Optimization, S S Rao, New Age International Pvt Ltd, 2003.
[6] Linear and Non-linear Optimization, **S**tephen G. Nash, A. Sofer, McGraw Hill, 2nd Edition.
[7] Engineering Optimization, A.Ravindran, K.M.Ragsdell, G.V.Reklaitis, Wiley India Pvt. Ltd, Second edition.
[8] Operations Research, F.S.Hiller, G.J.Lieberman, Tata McGraw Hill, Eighth Edition, 2005.
[9] Operations Research, P.K.Gupta, D.S.Hira, S.Chand and Company Ltd, 2014.

Digital Learning Resources:

Course Name: Foundations of Optimization
Course Link: https://nptel.ac.in/courses/111/104/111104071/
Course Instructor: Dr.Joydeep Dutta, IIT Kanpur

6th Semester		Power System Operation and Control	L-T-P 3-0-0	3 Credits

Module I: **(10 hours)**

Review of the structure of a Power System and its components. Per unit calculations. Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Load and Generator Specifications. Application of numerical methods for solution of nonlinear algebraic equations – Gauss Seidel, Coupled and Decoupled Newton-Raphson methods for the solution of the power flow equations. Regulating Transformers.

Module II: **(8 hours)**

Economic Operation and Management of Power System: Basic Pricing Principles: Generator Cost Curves, Utility Functions, Economic Operation with and without Transmission losses, Transmission loss coefficient, Economic Dispatch, Unit Commitment, Function of Load Dispatch Centres. Demand side-management.

Module III: **(10 hours)**

Control of Frequency and Voltage: Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing. Automatic Generation Control. Generation and absorption of reactive power by various components of a Power System. Excitation System Control in synchronous generators, Automatic Voltage Regulators, ALFC of Single and Two Area Systems.

Module IV: **(12 hours)**

Power System Stability: The Stability Problem, Rotor Dynamics and the Swing Equation, The Power-Angle Equation, Synchronizing Power Coefficients, Equal- Area Criterion for Stability, Multi-machine Stability Studies: Classical Representation, Step-By-Step Solution of the Swing Curve, Factors Affecting Transient Stability.

Books:

[1] J. Grainger and W. D. Stevenson, “Power System Analysis”, McGraw Hill Education, 1994.
[2] O. I. Elgerd, “Electric Energy Systems Theory”, McGraw Hill Education, 1995.
[3] D. P. Kothari and I. J. Nagrath, “Modern Power System Analysis”, McGraw Hill Education, 4th Edition, 2011.
[4] Power System Analysis- By Hadi Saadat, TMH, 2002 Edition, Eighth Reprint.
[5] C.L. Wadhwa, “Electrical Power Systems”, New Age International Publishers, 6th Edition.
[6] A. R. Bergen and V. Vittal, “Power System Analysis”, Pearson Education Inc, 1999.

Digital Learning Resources:

Course Name: Power System Analysis
Course Link: https://nptel.ac.in/courses/108/105/108105067/

Course Instructor: Prof. A K Sinha, IIT Kharagpur

Course Name: Power System Analysis
Course Link: https://nptel.ac.in/courses/117/105/117105140/
Course Instructor: Prof. D Das, IIT Kharagpur

Course Name: Power System Analysis
Course Link: https://nptel.ac.in/courses/108/104/108104051/
Course Instructor: Prof. Arindam Ghosh, IIT Kanpur

Course Name: Computer Aided Power System Analysis
Course Link: https://nptel.ac.in/courses/108/107/108107028/
Course Instructor: Dr. Vinay Pant and Dr. B. Das, IIT Roorkee

6th Semester	REL6D002	Electric and Hybrid Vehicles	L-T-P 3-0-0	3 Credits

Module I: **(10 Hours)**

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.

Module II: **(10 Hours)**

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

Module III: **(10 Hours)**

Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives. Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Hybridization of different energy storage devices.

Module IV: **(10 Hours)**

Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology. Battery Management System(BMS)/Energy Management System (EMS): Need of BMS, Rule based control and optimization based control, Software- based high level supervisory control, Mode of power transfer, Behaviour of drive motor. Electric Vehicles charging station: Type of Charging station, Selection and Sizing of charging station.

Books:

[1] Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003
[2] James Larminie, John Lowry, Electric Vehicle Technology Explained, Wi- ley, 2003.
[3] Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.

Digital Learning Resources:

Course Name: Introduction to Hybrid and Electric Vehicles
Course Link: https://nptel.ac.in/courses/108/103/108103009/
Course Instructor: Dr. Praveen Kumar and Prof. S. Majhi, IIT Guwahati

6th Semester	**REL6D002**	**Electric and Hybrid Vehicles**	**L-T-P 3-0-0**	**3 Credits**
6th Semester		**Advance Electronics Circuits**	**L-T-P 3-0-0**	**3 Credits**

Course Name: Electric Vehicles - Part 1
Course Link: https://nptel.ac.in/courses/108/102/108102121/
Course Instructor: Prof. Amit Jain, IIT Delhi

Course Name: Fundamentals of Electric vehicles: Technology & Economics
Course Link: https://nptel.ac.in/courses/108/106/108106170/
Course Instructor: Prof. Ashok Jhunjhunwala et al, IIT Madras

Module-I: **(10Hours)**

Active Filters :Active Filters, Frequency response of Major Active filters, First order low-pass Butterworth filter: Filter Design, Frequency Scaling, Second-order low- pass Butterworth filter: First- order high-pass Butterworth filter, Second-order high- pass Butterworth filter, Band-pass filters: Wide band-pass Filter, Narrow Band-Pass Filter, Band-reject filters: Wide Band-Reject Filter, Narrow Band- Reject Filter, All- Pass filter.
Oscillators: Oscillators: Oscillator Principles, Oscillator Types, Quadrature Oscillator, Saw tooth wave generator, Voltage-controlled oscillator.
Comparators: Comparators: basic comparator, zero-crossing detector, Schmitt trigger, comparator characteristics, limitations of Op-Amp as comparators, voltage limiters.

Module-II: (10Hours)
Bistable Multivibrator: Bistable Multivibrator, fixed-bias bistable multi vibrator, Loading, self-biased transistor binary, commutating capacitors, Triggering the binary, Unsymmetrical Triggering of the bistable multivibrator, Triggering Un symmetrically through a Unilateral Device, Triggering, Triggering of a Bistable Multi Symmetrically without the Use of Auxiliary Symmetrical Diodes, Schmitt Trigger Circuit (Emitter-coupled Bistable Multivibrator
Monostable and Astable Multivibrator: Monostable Multivibrator, Gate width of a Collector-Coupled Monostable Multivibrator, wave form of the Collector-Coupled Monostable Multivibrator, Emitter -Coupled Monostable Multivibrator, triggering of the Monostable Multivibrator, Astable Collector-Coupled Multivibrator, Emitter -Coupled Astable Multivibrator
Wideband amplifiers: Wideband amplifiers: The Hybrid-π, High-frequency, Small- signal, Common- emitter Model, RC-Coupled Amplifier, Frequency Response of a Transistor Stage-The Short-Circuit Current Gain, Current Gain with Resistive Load, Transistor Amplifier Response taking

Source Impedance into Account, Transient Response of a Transistor Stage.

Module-III: (10Hours)

Negative Resistance Switching Devices: Voltage Controllable Negative resistance devices, Tunnel Diode operation and characteristics, Monostable Astable, Bistable circuits using tunnel diode, Voltage controlled Negative Resistance Switching Circuits.

Voltage and Current Time Base Generators: Time-Base Generators, General features of a Time-base signal, Methods of generating a voltage time-base waveform, Exponential sweep circuit, Miller and bootstrap time base generators-Basic principles, Transistor miller time base generator, Transistor bootstrap time base generator, Current Time-Base Generators, A Simple Current sweep, Linearity Correction through adjustment of driving waveform, Transistor current time base generator.

ModuleIV (10 Hours)

Specialized IC Applications: IC 555 Timer: IC 555 Timer as a Monostable Multivibrator and its applications, IC 555 Timer as Astable Multivibrator and its applications. Phase Locked Loop: Operating principle of PLL, Phase detectors, Exclusive-OR phase detector, Monolithic phase detector, Instrumentation Amplifier and itsapplications.

Module V

Cascaded CE Transistor Stages, Rise-time Response of Cascaded Stages, Shunt Compensation of a Transistor Stage in a Cascade, Rise Time of Cascaded Compensated Stages, Low frequency Compensation.

Books:

[1] Pulse, Digital and switching Waveforms, Jacob Millman, Herbert Taub and MS Prakash Rao, TMH Publication, Second Edition.
[2] Pulse, Switching and Digital Circuits,David A. Bell, Oxford University Press, Fifth Edition.
[3] OP-Amps and Linear Integrated Circuits, Ramakant A. Gayakwad, PHI Publication.
[4] Pulse & Digital Circuits, K.Venkata Rao, K Rama Sudha& G Manmadha Rao, Pearson Education, 2010.
[5] OP-Amps and Linear Integrated Circuits, Robert F. Coughlin, Frederick F. Driscoll, Pearson Education Publication.
[6] Pulse and Digital Circuits**,** A. Anand Kumar, PHI.

6^{th} Semester	REL5D003	Biomedical Instrumentation	L-T-P 3-0-0	3 Credits

Module-I: **(13 Hours)**

Introduction to Bioengineering, Biochemical Engineering, Biomedical Engineering, Sources of Biomedical Signals, Basic medical Instrumentation systems and their need, use of microprocessors in medical instruments, PC based medical Instruments, general constraints in design of medical Instrumentation system & Regulation of Medical devices.

Bioelectrical Signals & Electrodes: Origin of Bioelectric Signals, Electrocardiogram, Electroencephalogram, Electromyogram, Electrode-Tissue Interface, Polarization, Skin Contact Impedance, Motion Artifacts.

Module-II: **(10 Hours)**

Electrodes for ECG: Limb Electrode, Floating Electrodes, Pre-gelled disposable Electrodes, Electrodes for EEG, Electrodes for EMG.

Physiological Transducers: Introduction to Transducers, Classification of Transducers, Performance characteristics of Transducers, Displacement, Position and flow and pressure Transducers.

Strain gauge pressure transducers, Thermocouples, Electrical Resistance Thermometer, The mister, Photovoltaic transducers, Photo emissive Cells & Biosensors (Biochemical sensors).

Module-III: **(10 Hours)**

Recording Systems: Basic Recording systems, General considerations for Signal conditioners, Preamplifiers, Differential Amplifier, Isolation Amplifier, Electrostatic and Electromagnetic Coupling to AC Signals, Proper Grounding (Common Impedance Coupling)

Books:

[1] Hand Book of Biomedical Instrumentation by R.S.Khandpur,-2nd Edition, Tata McGrawHill, 2003.
[2] Introduction to Biomedical Engineering by Michael M.Domach,Pearson Education Inc,-2004.
[3] Biomedical Instrumentation and Measurements- by Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, 2ndEdition, PHI learning Pvt. Ltd
[4] Introduction to Biomedical equipment technology,4e.ByJOSEPH.J.CAAR &JOHN M.BROWN (Pearson education publication).
[5] Medical Instrumentation-application & design. 3e – By JOHN.G.WEBSTER John Wiley & Sons publications.

Digital Learning Resources:

Course Name: Biomedical Signal Processing
Course Link: https://nptel.ac.in/courses/108/105/108105101/
Course Instructor: Prof.SudiptaMukhopadhyay , IIT Kharagpur

6th Semester		Artificial Intelligence and Machine Learning	L-T-P 3-0-0	3 Credits

Module-I: **(12 hours)**

INTRODUCTION –The Foundations of Artificial Intelligence; - INTELLIGENT AGENTS – Agents and Environments, Good Behaviour: The Concept of Rationality, the Nature of Environments, the Structure of Agents, SOLVING PROBLEMS BY SEARCH – Problem-Solving Agents, Formulating problems, Searching for Solutions, Uninformed Search Strategies, Breadth-first search, Depth-first search, Searching with Partial Information, Informed (Heuristic) Search Strategies, Greedy best-first search, A* Search, CSP, Means-End-Analysis.

Module-II: (12 hours)

ADVERSARIAL SEARCH – Games, The Mini-Max algorithm, optimal decisions in multiplayer games, Alpha-Beta Pruning, Evaluation functions, Cutting off search, LOGICAL AGENTS – Knowledge-Based agents, Logic, Propositional Logic, Reasoning Patterns in Propositional Logic, Resolution, Forward and Backward chaining - FIRST ORDER LOGIC – Syntax and Semantics of First-Order Logic, Using First-Order Logic , Knowledge Engineering in First-Order Logic - INFERENCE IN FIRST ORDER LOGIC – Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution

Module-III: **(6 hours)**

UNCERTAINTY – Acting under Uncertainty, Basic Probability Notation, The Axioms of Probability, Inference Using Full Joint Distributions, Independence, Bayes' Rule and its Use, PROBABILISTIC REASONING – Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distribution, Exact Inference in Bayesian Networks, Approximate Inference in Bayesian Networks

Module-IV: **(10 hours)**

LEARNING METHODS – Statistical Learning, Learning with Complete Data, Learning with Hidden Variables, Rote Learning, Learning by Taking Advice, Learning in Problem-solving, learningfrom Examples: Induction, Explanation-based Learning, Discovery, Analogy, FormalLearning Theory, Neural Net Learning and Genetic Learning. Expert Systems: Representingand Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.

Books:

[1] Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill,3rd ed.,2009

[2] Stuart Russell, Peter Norvig, *Artificial Intelligence -A Modern Approach*, 2/e, Pearson, 2003.

[3] Nils J Nilsson, *Artificial Intelligence: A New Synthesis*, Morgan Kaufmann Publications,2000

[4] Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.,2010

[5] S Kaushik, Artificial Intelligence, Cengage Learning, 1st ed.2011

Digital Learning Resources:

Course Name:	Artificial Intelligence Search Methods For Problem Solving
Course Link:	https://swayam.gov.in/nd1_noc20_cs81/preview
Course Instructor:	Prof. D. Khemani, IIT Madras

Fundamentals of Artificial Intelligence

Course Name:	
Course Link:	https://swayam.gov.in/nd1_noc20_me88/preview
Course Instructor:	Prof. S. M. Hazarika, IIT Guwahati
Course Name:	Introduction to Machine Learning
Course Link:	https://nptel.ac.in/courses/106/105/106105152
Course Instructor:	Prof. S. Sarkar, IIT Kharagpur
Course Name:	Machine Learning
Course Link:	https://nptel.ac.in/courses/106/106/106106202
Course Instructor:	Prof. Carl Gustaf Jansson, IIT Madras

6th Semester		Computer Organisation and Architecture	L-T-P 3-0-0	3 Credits

MODULE-I **(08Hours)**

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some commonCPUs.

MODULE-II(08Hours)

Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look- ahead adder, etc. multiplication – shift and add, Booth multiplier, carry save multiplier, etc. Division restoring and non restoring techniques, floating point arithmetic.

MODULE–III(08Hours)

Introduction to x86 architecture. CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU. Memory system design: semiconductor memory technologies, memory organization. Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes–role of interrupts in process state transitions, I/O device interfaces – SCII, USB

MODULE–IV(08Hours)

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, writepolicies.

Books:

[1] "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.

[2] "Computer Organization and Embedded Systems", 6th Edition byCarlHamacher, McGraw Hill Higher Education

[3] "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill

[4] "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.

[5] "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Digital Learning Resources:

Course Name: Computer Architecture and Organisation
Course Link: https://nptel.ac.in/courses/106/105/106105163/

Course Instructor:	Prof. Indranil Sengupta and Prof. Kamalika Datta, IIT Kharagpur

Course Name:	Computer Organisation and Architecture
Course Link:	https://nptel.ac.in/courses/106/106/106106166
Course Instructor:	Prof. V. Kamakoti, IIT Madras

Course Name:	ComputerOrganisation
Course Link:	https://nptel.ac.in/courses/106/106/106106092
Course Instructor:	Prof. S. Raman, IIT Madras

Course Name:	Computer Organisation and Architecture
Course Link:	https://nptel.ac.in/courses/106/104/106104073
Course Instructor:	Prof. B. Raman, IIT Kanpur

Course Name:	Computer Organisation and Architecture
Course Link:	https://nptel.ac.in/courses/106/103/106103068
Course Instructor:	Prof. J.K Deka, IIT Guwahati

Course Name:	Computer Organisation and Architecture- A Pedagogical Aspect
Course Link:	https://nptel.ac.in/courses/106/103/106103180
Course Instructor:	Prof. J.K Deka, Dr. S. Biswas and Prof. A. Sarkar, IIT Guwahati

6th Semester	RIK6F001	Essence of Indian Knowledge Tradition - I	L-T-P 3-0-0	0 Credits

Course Objective:

The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. The course focuses on introduction to 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.

Course Content:

- Basic Structure of Indian Knowledge System (i) वेद, (ii) उपवेद (आयुर्वेद, धनुर्वेद, गान्धर्वेद, स्थापत्य आदि) (iii) वेदांग (शिक्षा, कल्प, निरुत, व्याकरण, ज्योतिष छंद), (iv) उपाङ्ग (धर्म शास्त्र, मीमांसा, पुराण, तर्कशास्त्र)
- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case Studies.

Books:

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014

2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan

3. Fritzof Capra, Tao of Physics

4. Fritzof Capra, The wave of Life

5. V N Jha (Eng. Trans,), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation, Velliarnad, Amaku,am

6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta

7. GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, VidyanidhiPrakasham, Delhi, 2016

6th Semester	REL5C201	Communication Engineering Laboratory	L-T-P 0-0-3	2 Credits

8. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, VidyanidhiPrakasham, Delhi, 2016 9. P R Sharma (English translation), ShodashangHridayam

List of Experiments

(Perform any 10Experiments)

1 Analyse and plot the spectrum of following signals with aid of spectrum analyser: Sine wave, square wave, triangle wave, saw-tooth wave of frequencies 1 KHz, 10 KHz, 50 KHz, 100KKz and 1 MHz.
2 Analyse the process of frequency division multiplexing and frequency division demultiplexing.
3 Study and design of AM modulator and demodulator. (Full AM, SSB, DSBSC, SBSC)
4 Study of FM modulation and Demodulation Techniques.
5 Observer the process of PAM, quantization and determination of quantization noise. Multiplex 2-4 PAM/ PPM and PWM signals.
6 Using MATLAB/ LABVIEW generate a carrier and a modulating signal. Modulate thecarrier using AM. Show the waveform in time domain and analyze its frequencyspectrum. Repeat the simulation for modulating signal being square, triangular and other forms waveform.
7 Using MATLAB/ LABVIEW generate a carrier and a modulating signal. Modulate the carrier using FM. Show the waveform in time domain and analyze its frequency spectrum. Repeat the simulation for modulating signal being square, triangular and other forms waveform.
8 Using Lab-View software simulates AM modulation and demodulation system.
9 Using Lab-View software simulate FM modulation and demodulation system.
10 Design a receiver to demodulate and receive the signal from AM radio station.
11 Design a receiver to demodulate and receive the signal from the local FM radio station.

6th Semester	REEL6C202	Microprocessors and Microcontrollers Laboratory	L-T-P 0-0-3	2 Credits

List of Experiments

(Perform any 10 Experiments)

1. Programs for 16-bit arithmetic operations using8086.
2. Programs for Sorting and Searching (Using8086).
3. Programs for String manipulation operations (Using8086).
4. Programs for Digital clock and Stop watch (Using8086).
5. Interfacing ADC andDAC.
6. Parallel Communication between two MP Kits using Mode 1 and Mode 2 of8255.
7. Interfacing and Programming 8279, 8259, and8253.
8. Serial Communication between two MP Kits using8251.
9. Interfacing and Programming of Stepper Motor and DC Motor Speedcontrol.
10. Programming using Arithmetic, Logical and Bit Manipulation instructions of8051microcontroller.
11. Programming and verifying Timer, Interrupts and UART operations in8051
12. Communication between 8051 Microcontroller kit and PC.
13. A design problem using 8051 (A problem like multi-parameter data acquisition system, voltmeter, power meter, frequency counter, traffic simulation, digital clock,etc)

Digital Learning Resources:

6th Semester		Future-ready Contributor Program	L-T-P 0-0-3	2 Credits

Virtual Lab Link: http://vlabs.iitb.ac.in/vlabs-dev/labs_local/microprocessor/labs/explist.php

Outcomes: The Future-ready Contributor Program aims to accomplish the following outcomes in the lives of students–

- Improve the employability of students by giving them the right work ethic and thinking that employers are looking for.
- Build their confidence with which they can go into any job and contribute meaningfully.
- Improve their ability to engage better in the workplace and to be able to handle the challenges that come up there.
- Build their career-worthiness and help them develop into future-ready contributors with ability to navigate a career in a volatile, changing world.
- Widen their choices of career and success, so that they are able to open up more opportunities for themselves and take up unconventional career pathways.
- Enable them recognize how they as technical professionals, can participate and make a positive contribution to their communities and to their state.

The Program content is also designed to expose students to real-world workplace scenarios and sensitize them to some of the challenges faced in society around them, especially in the local communities around them and in their own state of Odisha.

The Contributor Program syllabus has been evolved and fine-tuned over several years, to –

a) address the changing need and contemporary challenges being faced by industry and what employers of today are looking for in the people they hire;
b) working extensively with universities and students and an appreciation of their challenges and concerns;
c) guided by the higher ideas and principles of practical Vedanta in work.

Sr. No.		Content	Total Hrs
1	Part 1 : Developing self-efficacy and basic inner strength	**Who is a Future-ready Contributor?** *In this topic, students understand the new work environment, expectations from future workforce, and importance of being a future-ready contributor. This enables students to transform their expectation of themselves in work*	3 hrs lab sessions (discovery-based facilitator led)
2		**Self-esteem & Growth Identity** *In this topic, students learn how to develop a deeper and more resilient self esteem and how to adopt a growth identity/ mindset, that is more appropriate to the demands of the future workplace.*	Same as above
3		**Become a Creator of one's destiny** *In a "victim stance", we see the career environment as full of difficulties and hurdles. We feel powerless or blame our circumstances for not having many opportunities. This makes us fearful of uncertainty and makes us settle for jobs where we remain mediocre. In this topic, students discover the "creator of destiny stance" to challenges and situations. This stance helps them take ownership & responsibility to shape destiny, build a new future & find answers to challenges; and stop being complainers.*	Same as above
4	Part 2 : Building ability to make more effective career choices	**Achieving Sustainable Success** *In this topic, students discover how to achieve sustainable or lasting success, by making themselves success-worthy. Where their focus shifts to building one's "engine of success" rather than being on chasing the "fruits of success". This is important, because over a lifetime of work, all people go through ups and downs – where the fruits are not in their control. People who are focused on the fruits of success, fall prey to disappointment, loss in motivation, quitting too early, trying to find shortcuts – when fruits don't come. Whereas people focused on building their engine of success continue to contribute steadily, irrespective of whether fruits come or not. This helps them make better choices in life, that leads to steady success & long-term career fulfillment in an uncertain world.*	Same as above

5		**Career Development Pathways for a changing world** *In this topic, students explore a range of diverse "career development models" and the possibilities for contribution each opens up to them. This helps them open up hidden opportunities that such an environment offers. And free themselves from a herd mentality when making career choices.*	Same as above
6		**Make an impact in every part of one's life** *In this topic, students learn how to expand the contribution possible in any role they have. This helps them take charge of own career growth & discover their power to contribute in any role or job.*	Same as above
7	**Part 3 : Building ability to become solution and value creating individuals in the world**	**Think Solutions** *The market environment in which organizations are operating, is becoming increasingly dynamic and uncertain. So, employers are increasingly seeking out people who can innovate and figure out solutions in the face of any challenge (unlike in the past when it was the people who were most efficient and productive, who were valued by organizations). At the heart of innovation lies this way of thinking of "finding solutions" rather than "seeing problems or roadblocks". Students learn how to build this way of thinking, in this topic.*	Same as above
8		**Value Thinking** *Companies are also looking for employees who do not just work hard, or work efficiently or productively - but those who will make a valuable difference to the fortunes of the company. This difference may come from innovation, but it may also come from focusing on the right things and identifying what really matters – both to the company and to the customers. In this topic, students learn how to build this capability.*	Same as above
9		**Engaging Deeply** *The environment we live in is becoming increasingly complex because more and more things are getting interconnected, new fields are emerging, technologies are rapidly changing, capabilities and knowledge one is trained in will become fast obsolete. In such a scenario, the student's ability to quickly understand and master what is going on, dive deep, get involved in any area, rapidly learn*	Same as above

		new capabilities that a job demands, is important. In this topic, students learn how to engage deeply. Learning how to dive deep, to quickly understand what is going on, get involved in any area, and rapidly learn.	
10	**Part 4 : Building ability to work collaboratively and as good citizens of organizations and the country**	**Enlightened self-interest & collaboration at work** *The changing nature of work in organizations and in the global environment, is increasingly demanding that people work more collaboratively towards shared goals and more sustainable goals. A key to working successfully when multiple stakeholders are involved, is "thinking in enlightened self-interest". In this topic, students learn how to widen their thinking from "narrow self-interest" to "enlightened self-interest" to work more effectively in teams & collaboratives.*	Same as above
11		**Human-centered thinking & Empathy** *In this topic, students learn to recognize & respond to human needs and challenges – the way of thinking at the heart of user-centric designs & customer-centricity.*	Same as above
12		**Trust Conduct** *The biggest currency in a sustainable career is "trust" i.e. being trusted by team members, bosses, customers. When we are trusted, people listen to us, they are willing to give us the chance to grow, give us the space to make mistakes, and work seamlessly with each other without always having to "prove ourselves". In this topic, students learn how to build trust with people they engage with.*	Same as above
Contribution Project Lab Sessions		*3 Contribution projects that help them apply contributor thinking. After students complete their project work (beyond the classroom), each project ends with this 3 hr lab session where they build their project output and present.*	9 hrs (3 hr lab sessions for each of 3 projects)
Project work		*The above Contribution Projects require research, and may need field work beyond the classroom that students are expected to do.*	Beyond classroom

Lab Sessions:

- Students will have to attend twelve discovery-based lab sessions to build new models of thinking & capacities (3 hrs per module)
- They will work closely with their peers to discuss and understand these new models of thinking.
- Their learning will be facilitated by trained college faculty.

Contribution Projects

- Three contribution projects that help them apply contributor thinking
- These will require research and also may need field work
- Each ends with a 3 hr lab session where they build their project output and present