E.G.S.PILLAYENGINEERINGCOLLEGE(Autonomous)

Approved byAICTE,New Delhi|Affiliated to AnnaUniversity, Chennai Accredited byNAAC with "A" Grade|Accredited byNBA (CSE, EEE, MECH)

NAGAPATTINAM–611002

B.E. Biomedical Engineering

SEMESTER V									
Course Code	Course Name	L	T	P	C	Maximum Marks			Category
						CIA	ES	Total	
Theory Course									
1902BM501	Biomedical Equipment"s	3	0	0	3	40	60	100	PC
1902BM502	Medical Optics	3	0	0	3	40	60	100	PC
1902BM503	Microprocessor and its Applications	3	2	0	3	40	60	100	PC
1902BM504	Biomedical Digital Signal Processing	3	0	0	4	40	60	100	PC
1902BM505	Bio Process Control	3	0	0	3	40	60	100	PC
	Professional Elective – I	3	0	0	3	40	60	100	PE
Laboratory Course									
1902BM551	Biomedical Digital Signal Processing Laboratory	0	0	4	2	50	50	100	PC
1902BM552	Biosensors and Transducers Laboratory	0	0	4	2	50	50	100	PC
1904BM553	Microprocessor and Its Applications Laboratory	0	0	4	2	50	50	100	PC
1904GE551	Life Skills: Aptitude – I	0	0	2	1	100	-	100	EEC
Audit Course									
1901MCX03	Essence of Indian Traditional Knowledge	2	0	0	0	100	-	100	AC
Total		**20**	**2**	**14**	**26**	**590**	**510**	**1100**	

1902BM501	BIOMEDICAL EQUIPMENT'S	L	T	P	C
		3	0	0	3

Course Objectives:

1. To Introduce the various mechanical techniques that will help failing heart.
2. To study the functioning of the unit which does the clearance of urea from the blood.
3. To Understand the tests to assess the hearing loss and development of electronic devices to compensate for the loss.
4. To develop the various orthotics devices and prosthetic devices to overcome orthopedic problems.
5. To expose electrical stimulation techniques used in clinical applications

UNIT I	**CARDIAC ASSIST DEVICES**	**9 Hours**

Principle of External counter pulsation techniques, intra aortic balloon pump, Auxiliary ventricle and schematic for temporary bypass of left ventricle, prosthetic heart valves.

UNIT II	**HEMODIALYSERS**	**9 Hours**

Artificial kidney, Dialysis action, haemodialyser unit, membrane dialysis, portable dialyser monitoring and functional parameters

UNIT III	**HEARING AIDS**	**9 Hours**

Common tests – audiograms, air conduction, bone conduction, masking techniques, SISI, Hearing aids – principles, drawbacks in the conventional unit, DSP based hearing aids.

UNIT IV	**PROSTHETIC AND ORTHODIC DEVICES**	**9 Hours**

Hand and arm replacement – different types of models, externally powered limb prosthesis, feedback in orthodic system, functional electrical stimulation, sensory assist devices.

UNIT V	**RECENT TRENDS**	**9 Hours**

Transcutaneous electrical nerve stimulator, bio-feedback.

Total:	**45 Hours**

Further Reading:

- Learn about ECG,EEG and its applications

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Explain the functioning and usage of electromechanical units which will restore normal functional ability of particular organ that is defective temporarily or permanently.
2. Understand what is meant by assistive technology
3. Recognise different forms of assistive technology
4. Understand some students‟ experiences of using assistive technology.
5. Discuss the Importance of Recent Technologies.

Text Books:

1. John G. Webster, ―Medical Instrumentation Application and Design‖, 4th edition, Wiley India PvtLtd,New Delhi, 2015.
2. Joseph J. Carr and John M. Brown, ―Introduction to Biomedical Equipment Technology‖, Pearson education, 2012.

References:

1. Levine S.N. (ed), "Advances in Bio-medical Engineering and Medical physics", Vol. I, II, IV, inter university publications, New York, 1968 (Unit I, IV, V).
2. Kopff W.J, "Artificial Organs", John Wiley and sons, New York, 1976. (Unit II).
3. Albert M.Cook and Webster J.G, "Therapeutic Medical Devices", Prentice Hall Inc., New Jersey,1982 (Unit III).
4. D.S. Sunder, "Rehabilitation Medicine", 3rd Edition, Jaypee Medical Publication, 2010

1902BM502	MEDICAL OPTICS	L	T	P	C
		3	0	0	3

Course Objectives:

1. To Discuss the optical properties of the tissues and the interactions of light with tissues.
2. To understand the instrumentation and components in Medical Optics.
3 To describe the Medical Lasers and their applications
4 To explain the optical diagnostic applications
5 To know the emerging optical diagnostic and therapeutic techniques

UNIT I	OPTICAL PROPERTIES OF THE TISSUES	9 Hours

Refraction, Scattering, absorption, light transport inside the tissue, tissue properties, Light interaction with tissues, optothermal interaction, fluorescence, speckles.

UNIT II	INSTRUMENTATION IN PHOTONICS	9 Hours

Instrumentation for absorption, scattering and emission measurements, excitation light sources – high pressure arc lamp, solid state LEDs, Lasers, optical filters, polarizer, solid state detectors, time resolved and phase resolved detectors.

UNIT III	APPLICATIONS OF LASERS	9 Hours

Lasers in ophthalmology, Dermatology, Dentistry, Urology, Otolaryngology, Tissue welding and Soldering.

UNIT IV	OPTICAL TOMOGRAPHY	9 Hours

Optical coherence tomography, Elastrography, Doppler optical coherence tomography, Application towards clinical imaging.

UNIT V	SPECIAL OPTICAL TECHNIQUES	9 Hours

Near field imaging of biological structures, in vitro clinical diagnostic, fluorescent spectroscopy, photodynamic therapy.

Total:	45 Hours

Further Reading:

- Learn about laser Characteristics as applied to medicine and biology
- Non thermal diagnostic applications

Course Outcomes:

At the end of the course, the students should be able to:

1. Demonstrate knowledge of the fundamentals of optical properties of tissues
2. Analyze the components of instrumentation in Medical Photonics and Configurations
3. Describe surgical applications of lasers.
4. Describe photonics and its diagnostic applications.
5. Investigate emerging techniques in medical optics

Text Books:

1. Tuan Vo Dirh, ―Biomedical Photonics – Handbook‖, CRC Press, Bocaraton, 2014.
2. Paras N. Prasad, ―Introduction to Biophotonics‖, A. John Wiley and Sons, Inc. Publications, 2003

References:

1. Markolf H.Niemz, ―Laser-Tissue Interaction Fundamentals and Applications‖, Springer, 2007
2. G.David Baxter ―Therapeutic Lasers – Theory and practice‖, Churchill Livingstone publications Edition-2001.
3. Leon Goldman, M.D., & R.James Rockwell, Jr., ―Lasers in Medicine‖, Gordon and Breach, Science Publishers Inc., 1975.

1902BM503	MICROPROCESSOR AND ITS APPLICATIONS	L	T	P	C
		3	2	0	3

Course Objectives:

1. To introduce the basic concepts of microprocessor
2. To explain the knowledge of Programming of 8085 processor
3. To educate the fundamentals of Peripheral Interfacing.
4. To describe about the RISC Processor, ARM Processor
5. To gain the basic knowledge about advanced processors

UNIT I **MICROPROCESSOR-8085** **9 Hours**

Evolution & Importance of microprocessor, Microprocessor-8085: Functional block diagram - Signals– Memory interfacing – I/O ports and data transfer concepts – Timing Diagram – Interrupt structure, 8086 Architecture

UNIT II **PROGRAMMING OF 8085 PROCESSOR** **9 Hours**

Instruction format and addressing modes – Assembly language format – Data transfer, data manipulation & control instructions – Programming: Loop structure with counting & Indexing - Look up table - Subroutine instructions stack.

UNIT III **PERIPHERAL INTERFACING** **9 Hours**

Interfacing: Memory- and I/O- interfacing- Programmable Peripheral Interface (PPI)-8255:Pin diagram, block diagram, and operating modes- USART: Pin diagram, block diagram, and command word- Programmable Interrupt Controller (PIC)-8259A: Pin diagram, block diagram, interrupt sequence, and cascading- Keyboard/Display Controller-8279: Pin diagram, block diagram, operating modes.

UNIT IV **ARCHITECTURE OF ADVANCED PROCESSORS** **9 Hours**

Multiprocessor configurations – Intel 80286 – Internal Architectural – Register Organization – Internal Block Diagram – Architectural features and Register Organization of i386, i486 and Pentium processors. ARM architecture.

UNIT V **APPLICATIONS IN MEDICINE** **9 Hours**

Mobile phone based bio signal recording, microprocessor based vision architecture for integrated diagnostic helping devices, Microprocessor based remote health monitoring system: Concept and systems, and system operation.

Total: 45 Hours

Further Reading:

- Intel Core i3, i5 and i7

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Apply knowledge of microprocessor based systems and interfacing techniques.
2. Identify CPU and memory timing parameters.
3. Draw a bus timing diagram for a simplex CPU-memory interface
4. Identify the critical read and write cycle paths on a bus timing diagram.

Text Books:

1. Sunil Mathur &Jeebananda Panda, "Microprocessor and Microcontrollers", PHI Learning Pvt. Ltd, 2016.
2. R.S. Gaonkar, „Microprocessor Architecture Programming and Application", with 8085, Wiley Eastern Ltd., New Delhi, 2013.
3. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely „The 8051 Micro Controller and Embedded Systems", PHI Pearson Education, 5th Indian reprint, 2003.

References:

1. Douglas V Hall, "Microprocessors and interfacing, programming and hardware" TMH, 2006.
2. Ramesh S.Gaonkar "Microprocessor architecture, programming and its application with 8085", Penram Int. Pub. (India), Fifth edition, 2002.
3. Roy A.K, Bhurchandi K.M," "Intel Microprocessors Architecture, Programming and Interfacing", McGraw Hill International Second Edition, 2006.
4. Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing The PC", Delmar Publishers, 2007.
5. A. K. Ray & K. M. Bhurchandi, "Advanced Microprocessors and peripherals- Architectures, Programming and Interfacing", TMH, 2002 reprint.

1902BM504	BIOMEDICAL DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	4

Course Objectives:

1. To study about a programmable Digital signal processor.
2. To learn discrete Fourier transform, properties and its computation
3. To know the characteristics of IIR filter and to learn the design of IIR filters for filtering undesired signals.
4. To Introduce the time frequency signal analysis methods
5. To understand Data reduction techniques

UNIT I	CLASSIFICATION OF SIGNALS AND SYSTEMS	9 Hours

Concept of signals - Classification of signals - Singularity functions - Classification of systems Representation of systems

UNIT II	DISCRETE FOURIER TRANSFORM AND COMPUTATION	9 Hours

Discrete Fourier Transform- properties, magnitude and phase representation -Computation of DFT using FFT algorithm – DIT &DIF using radix 2 FFT – Butterfly structure.

UNIT III	CONCEPTS OF DIGITAL FILTERING	9 Hours

Digital filters -Basics of signal averaging, Signal averaging as a digital filter FIR filter - IIR filter - Adaptive filters - Comparison of filters

UNIT IV	TIME FREQUENCY SIGNAL ANALYSIS METHODS	9 Hours

Trigonometric Fourier series -Fourier transform- Correlation- Convolution- Frequency domain analysis of ECG signal- Basic concept of wavelet - Wavelet transform- Applications of wavelet transform in biomedical instruments

UNIT V	DATA REDUCTION TECHNIQUES	9 Hours

Data reduction techniques -Types of data reduction techniques -Redundancy - Irrelevancy removal

	Total:	45+15 Hours

Further Reading:

- Compare the digital filters over analog filters
- Apply the data reduction techniques in biomedical field.

Course Outcomes:

After completion of the course, Student will be able to:

1. Gain the knowledge about DSP Processors.
2. Apply DFT for the analysis of digital signals & systems.
3. Design of IIR filters for filtering undesired signals.
4. Describe the time frequency signal analysis methods
5. Discuss the importance of Data reduction techniques.

Text Books:

1. John G. Proakis & Dimitris G.Manolakis, ―Digital Signal Processing – Principles, Algorithms & Applications‖, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, ―Signals and Systems‖, Pearson, 2015

References:

1. Salivahanan S. ,Vallavaraj A., Gnanapriya C, Digital Signal Processing, Tata McGraw- Hill, New Delhi, 2008.
2. S.K. Mitra, „Digital Signal Processing – A Computer Based Approach‟, McGraw Hill Edu, 2013.
3. RangayannRangraj M, Biomedical Signal Analysis, IEEE Press, New York, 2002.
4. Tompkins Willis J., Biomedical Digital Signal Processing, PHI Learning, New Delhi, 2001
5. NajarianKayvan, Biomedical Signal and Image Processing, CRC Press, 2009

1902BM505 **BIO PROCESS CONTROL**

L	T	P	C
3	0	0	3

Course Objectives:

1. To introduce technical terms and nomenclature associated with Process control domain
2. To familiarize the students with characteristics, selection, sizing of control valves.
3. To provide an overview of the features associated with Industrial type PID controller.
4. To make the students understand the various PID tuning methods.
5. To elaborate different types of control schemes such as cascade control, feed forward control and Model Based control schemes.

UNIT I PROCESS MODELLING AND DYNAMICS **9 Hours**

Need for process control – Mathematical Modeling of Processes**:** Level, Flow, Pressure and Thermal processes – Continuous and batch processes – Self regulation – Servo and regulatory operations – Lumped and Distributed parameter models – Heat exchanger – CSTR .

UNIT II FINAL CONTROL ELEMENTS **9 Hours**

Actuators: Pneumatic and electric actuators – Control Valve Terminology - Characteristic of Control Valves: Inherent and Installed characteristics - Valve Positioner – Modeling of a Pneumatically Actuated Control Valve – Control Valve Sizing: ISA S 75.01 standard flow equations for sizing Control Valves – Cavitation and flashing – Control Valve selection

UNIT III CONTROL ACTIONS **9 Hours**

Characteristic of ON-OFF, Proportional, Single speed floating, Integral and Derivative controllers – P+I, P+D and P+I+D control modes – Practical forms of PID Controller – PID Implementation Issues**:** Bumpless, Auto/manual Mode transfer, Anti-reset windup Techniques – Direct/reverse action.

UNIT IV PID CONTROLLER TUNING **9 Hours**

PID Controller Design Specifications**:** Criteria based on Time Response and Criteria based Frequency Response - PID Controller Tuning**:** Z-N and Cohen-Coon methods, Continuous cycling method and Damped oscillation method, optimization methods, Auto tuning – Cascade control – Feed-forward control

UNIT V MODEL BASED CONTROL SCHEMES **9 Hours**

Smith Predictor Control Scheme - Internal Model Controller – IMC PID controller –- Three element Boiler drum level control - Introduction to Multi-loop Control Schemes – Control Schemes for CSTR, and Heat Exchanger - P&ID diagram.

Total: 45 Hours

Further Reading:

- Bio receptors and Bio detectors
- DNA Sequencing with nano pores

Course Outcomes:

1. Ability to understand technical terms and nomenclature associated with Process control domain.
2. Ability to build models using first principles approach as well as analyze models.
3. Ability to Design, tune and implement PID Controllers to achieve desired performance for various processes
4. Ability to Analyze Systems and design & implement control Schemes for various Processes.
5. Ability to Identify, formulate and solve problems in the Process Control Domain

Text Book

1. Seborg, D.E., Edgar, T.F. and Mellichamp, D.A., "Process Dynamics and Control", Wiley John and Sons, 2nd Edition, 2003.
2. Bequette, B.W., "Process Control Modeling, Design and Simulation", Prentice Hall of India, 2004.
3. Stephanopoulos, G., "Chemical Process Control - An Introduction to Theory and Practice", Prentice Hall of India, 2005.

Reference

1. Coughanowr, D.R., "Process SystemsAnalysis and Control", McGraw - Hill International Edition,2004.
2. Curtis D. Johnson, "Process Control Instrumentation Technology", 8th Edition, Pearson, 2006.
3. Considine, D.M., Process Instruments and Controls Handbook, Second Edition, McGraw,1999.

1902BM551	BIOMEDICAL DIGITAL SIGNAL PROCESSING LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives:

1. To make the students understand the behavior and response of the filter using different methods
2. To study the output response of the system, sampling rate conversion and FFT spectrum
3. To know the generation of the signals and arithmetic operations using TMS320C5X DSP Processor.
4. To compute the convolution and correlation of signals using DSP‟s
5. To Implement the IIR filter using DSP‟s

List of Experiments:

1. Generation of Signals
2. Properties of Discrete time Systems-Linearity, Stability, Causality &Time Variance.
3. Sampling of an audio signal with different sampling rate and reconstruct the sampled signal.
4. Computation of DFT of a signal using basic equation and FFT & power spectrum estimation using DFT
5. Design and Simulation of IIR filters.
6. Design and Simulation of FIR filters
7. Multirate signal processing-Down sampling , Up sampling , Decimation and Interpolation
8. Arithmetic operations in DSPs
9. Generation of waveforms using DSPs
10. Computation of convolution and correlation between signals using DSPs
11. Implementation of IIR Filters using DSPs
12. Implementation of FIR Filters using DSPs

Additional Experiments:

1. Basic experiments using ADSP processor

Course Outcomes:

After completion of the course, Student will be able to:

1. Design of digital filter and Generation of various signals, Analysis of signal and system properties.
2. Computation of circular and linear convolution.
3. Determine the frequency transformation and Analysis of sampling rate.
4. Design of digital filters.
5. Analyze the power spectral density of the system.

References:

1. J.G. Proakis and D.G. Manolakis, „Digital Signal Processing Principles, Algorithms and Applications‟, Pearson Education, New Delhi, PHI. 2003.
2. S.K. Mitra, „Digital Signal Processing – A Computer Based Approach‟, McGraw Hill Edu, 2013.
3. B.Venkataramani and M.Bhaskar, “Digital Signal Processors – Architecture, Programming and Applications” – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.

Equipment List

S.NO	Name of the Equipment	Quantity Available
1	**PCs with Fixed / Floating point DSPProcessors**(Kit / Add-on Cards)	**10**
2	MATLAB with Simulink and Signal Processing Tool Box or Equivalent Software in desktop systems	**10**
3	Signal Generators (1MHz)	**2**
4	CRO (20MHz)	**2**

1902BM552	BIOSENSORS AND TRANSDUCERS LAB	L	T	P	C
		0	0	4	2

Course Objectives:

1. To display and record signals using CRO.
2. To implement digital to analog converter.
3. To analyse step response of a thermometer and measure temperature using various temperature transducers.
4. To measure displacement using various displacement transducers.
5. To measure pressure using a pressure transducer.
6. To measure pH of a solution using pH electrodes

List of Experiments:

1. Study of Front panel of CRO
2. A to D converter
3. To study the dynamic behaviour of thermometer system.
4. To study the characteristics of a thermistor
5. To study thermistor linearization.
6. To study the characteristics of a light dependent resister.
7. To study the principle and working of a thermocouple
8. To study principle and working of LVDT
9. To study principle and working of a capacitive Transducer.
10. To study principle and working of a strain gage sensor.

Additional Experiments:

1. To study principle and working of a pressure sensor.
2. To study pH electrode.

Course Outcomes:

After completion of the course, Student will be able to:

1. Record and display signals using CRO.
2. Measure pH of a solution using pH electrodes.
3. Convert analog data into digital form
4. Analyse step response of a thermometer and measure temperature using various temperature transducers.
5. Measure displacement using various displacement transducers
6. Measure pressure using a pressure transducer

REFERENCES:

1. Principles of applied Biomedical Instrumentation by La Geddes and L.E. Baker..
2. Biomedical Instrumentation and Measurement by Leslie Cromwell, Fred. J. Weibell and Pfeiffer
3. Principles of Biomedical Instrumentation and Measurement, Richard Aston, Merril Publishing Co., Columbus, 1990.

Equipment List

S.NO	Name of the Equipment	Quantity Available
1	CRO	1
2	A to D converter	1
3	Thermometer system.	1
4	Thermistor	1
5	Light dependent resister.	1
6	Thermocouple	1
7	LVDT	1
8	Capacitive Transducer.	1
9	Strain gage sensor.	1
10	Pressure sensor.	1
11	PH electrode.	1

1904BM553	Microprocessor and its Applications Laboratory	L	T	P	C
		0	0	4	2

Course Objectives:

1. To Write ALP for arithmetic and logical operations in 8085
2. To Explain ALP for arithmetic and logical operations in 8086
3. To Differentiate Serial and Parallel Interface
4. To Interface different I/Os with Microprocessors
5. To experiment on Arduino processor.

8085 Programs using kits

1. Basic arithmetic and Logical operations
2. Sorting and Searching the given data.

8086 Programs using kits with MASM

3. Floating point operations

Peripherals and Interfacing Experiments

4. Traffic light control
5. Stepper motor and DC Motor control
6. Key board and Display
7. Serial interface and Parallel interface
8. Printer Interfacing
9. A/D and D/A interface and Waveform Generation

Total: 45 Hours

AdditionalExperiments:

10. Basic experiments using Arduino processor

Course Outcomes:

After completion of the course, Student will be able to:

1. Write ALP Programmes for fixed and Floating Point and Arithmetic
2. Interface different I/Os with processor
3. Generate waveforms using Microprocessors
4. Explain the difference between simulator and Emulator

References:

1. Ramesh Gaonkar "Microprocessor Architecture, Programming, and Applications with the 8085"- 5th edition Penram International Publishing-2000.
2. A. K. Ray & K. M. Bhurchandi, “Advanced Microprocessors and peripherals- Architectures, Programming and Interfacing”, TMH, 2002 reprint.

Equipment List:

S.NO	Name of the Equipment	Quantity Required (R)	Quantity Available (A)	Deficiency (R –A)
1	8086 Microprocessor trainer kit with power supply	**10**	**10**	
2	8051 Microcontroller trainer kit	**15**	**15**	
3	Traffic light control interfacing card compatible with 8086 & 8051 kits	**5**	**5**	
4	Stepper motor control interfacing compatible with 8086 & 8051kits	**5**	**5**	
5	Digital clock interfacing board compatible with 8086 & 8051 kits	**5**		
6	Keyboard & Display Interface board compatible with 8086 & 8051 kits	**5**	**5**	
7	Printer interfacing card compatible with 8086 & 8051 kits	**5**		
8	A/D and D/A interfacing board with 8086 & 8051 kits	**5**	**5**	
9	Serial and Parallel Interfacing board with 8086 & 8051 kits	**5**	**5**	

1904GE551	LIFE SKILLS: APTITUDE - I	L	T	P	C
		0	0	2	1

Course Objectives:

1. To brush up problem solving skill and to improve intellectual skill of the students
2. To be able to critically evaluate various real life situations by resorting to Analysis Of key issues and factors
3. To be able to demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
4. To enhance analytical ability of students
5. To augment logical and critical thinking of Student

UNIT I	INTRODUCTION TO NUMBER SYSTEM, BASIC SHORTCUTS OF ADDITION, MULTIPLICATION, DIVISION	5 Hours

Classification of numbers – Types of Numbers - Divisibility rules - Finding the units digit - Finding remainders in divisions involving higher powers - LCM and HCF Models - Fractions and Digits – Square, Square roots – Cube, Cube roots – Shortcuts of addition, multiplication, Division.

UNIT II	RATIO AND PROPORTION, AVERAGES	5 Hours

Definition of Ratio - Properties of Ratios - Comparison of Ratios - Problems on Ratios - Compound Ratio - Problems on Proportion, Mean proportional and Continued Proportion Definition of Average - Rules of Average - Problems on Average - Problems on Weighted Average - Finding average using assumed mean method.

UNIT III	PERCENTAGES, PROFIT AND LOSS	5 Hours

Introduction Percentage - Converting a percentage into decimals - Converting a Decimal into a percentage - Percentage equivalent of fractions - Problems on percentages - Problems on Profit and Loss percentage- Relation between Cost Price and Selling price - Discount and Marked Price - Two different articles sold at same Cost Price - Two different articles sold at same Selling Price - Gain% / Loss% on Selling Price.

UNIT IV	CODING AND DECODING, DIRECTION SENSE	5 Hours

Coding using same set of letters - Coding using different set of letters - Coding into a number - Problems on R-model - Solving problems by drawing the paths - Finding the net distance travelled - Finding the direction - Problems on clocks - Problems on shadows - Problems on direction sense using symbols and notations.

UNIT V	NUMBER AND LETTER SERIES NUMBER AND LETTER ANALOGIES, ODD MAN OUT	5 Hours

Difference series - Product series - Squares series - Cubes series - Alternate series - Combination series - Miscellaneous series - Place values of letters - Definition of Analogy - Problems on number analogy - Problems on letter analogy - Problems on verbal analogy - Problems on number Odd man out - Problems on letter Odd man out - Problems on verbal Odd man out

	Total:	30 Hours

ASSESSMENT PATTERN :

1. Two tests will be conducted (25 * 2) - 50 marks
2. Five assignments will be conducted (5*10) - 50 Marks

Course Outcomes:

After completion of the course, Student will be able to:

1. Learners should be able to understand number and solving problems least time using various shortcut
2. Solve problems on averages; compare two quantities using ratio and proportion.
3. Calculate concept of percentages, implement business transactions using profit and loss.
4. Workout concepts of Coding and Decoding, ability to visualize directions and understand the logic behind a sequence.
5. Learners should be able to find a series the logic behind a sequence.

References:

1. Arun Sharma, „How to Prepare for Quantitative Aptitude for the CAT", 7th edition, McGraw Hills publication, 2016.
2. Arun Sharma, „How to Prepare for Logical Reasoning for CAT", 4th edition, McGraw Hills publication, 2017.
3. R S Agarwal, „A modern approach to Logical reasoning", revised edition, S.Chand publication, 2017.
4. R S Agarwal, „Quantitative Aptitude for Competitive Examinations", revised edition, S.Chand publication, 2017.
5. Rajesh Verma, "Fast Track Objective Arithmetic", 3rd edition, Arihant publication, 2018.
6. B.S. Sijwalii and InduSijwali, "A New Approach to REASONING Verbal & Non-Verbal", 2nd edition, Arihnat publication, 2014.

1901MCX03 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

L	T	P	C
2	0	0	0

MODULE I INTRODUCTION TO CULTURE **6 Hours**

Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

MODULE II INDIAN LANGUAGES, CULTURE AND LITERATURE **6 Hours**

Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India Indian Languages and Literature-II: Northern Indian languages & literature .

MODULE III RELIGION AND PHILOSOPHY **6 Hours**

Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only) .

MODULE IV FINE ARTS IN INDIA (ART, TECHNOLOGY& ENGINEERING) **6 Hours**

Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India .

MODULE V EDUCATION SYSTEM IN INDIA **6 Hours**

Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India.

TOTAL 30 Hours

REFERENCES:

1. Kapil Kapoor, “Text and Interpretation: The India Tradition”,ISBN: 81246033375, 2005

2. “Science in Samskrit”, SamskritaBharti Publisher, ISBN 13: 978-8187276333, 2007

3. NCERT, “Position paper on Arts, Music, Dance and Theatre”, ISBN 81-7450 494-X, 200

4. S. Narain, “Examinations in ancient India”, Arya Book Depot, 1993

5. SatyaPrakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989

6. M. Hiriyanna, “Essentials of Indian Philosophy”, MotilalBanarsidass Publishers, ISBN 13: 978- 8120810990, 2014