RAMAIAH
Institute of Technology

CURRICULUM

Academic Year 2023– 2024

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

III & IV Semester B. E.

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
BANGALORE – 54

About the Institute:

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 17 UG programs and 15 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with **'A^{+}' grade by NAAC in March 2021** for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute is also been conferred autonomous status for Ph.D program since 2021. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 65% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems, Schneider Centre of Excellence & Centre for Bio and Energy Materials Innovation. **M S Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 107 & world ranking 600 for the year 2022.** The Entrepreneurship Development Cell (EDC) and Section 8 company "Ramaiah Evolute" have been set up on campus to incubate startups. **M S Ramaiah Institute of Technology is recognized by Atal Ranking of Institutions on Innovation Achievements (ARIIA), MoE, Govt. of India.** MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. MSRIT is a member of DELNET, CMTI and VTU E-Library Consortium. MSRIT has a modern auditorium and several hi-tech conference halls with video conferencing facilities. The institute has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, M S Ramaiah Institute of Technology has achieved 67th rank among 1249 top Engineering Institutions & 17th Rank for School of Architecture in India for the year 2022 and is 1st amongst the Engineering Colleges affiliated to VTU, Karnataka.

About the Department:

The Department was established in the year 1992 as Instrumentation Technology and was renamed as Electronics and Instrumentation Engineering (EIE) in the year 2014 by VTU. The department offers UG course which is recognized by AICTE and accredited by NBA, four times (up to 2022). The department is recognised as a Research Centre by VTU, Belagavi and offers Ph.D and MSc.(Engg.) by research programs. All the faculty members are doctorates and are actively engaged in R&D activities.

The department is focussed on empowering the students with technical knowledge and practical skills in the areas of Instrumentation Technology and Industrial Automation System in line with Industry 4.0. The department is equipped with modern laboratories including Allen Bradley PLCs, SCADA from Schneider Electric, Ocean Optics Optical Spectrometer and research software such as Neuroshell predictor and classifier to name a few.

The course and curriculum is basically multi-disciplinary in nature and revolves around electronics, computers and embedded systems. The focus is on the design and control of automated systems. In line with Industry 4.0 standards, the department is also focussed on offering courses on automation, bridging the gap between academia and industries. The emphasis is on hands on training with PLCs, SCADA, Robotics, Automation and IoT. With wide exposure to theory and hands-on training in the modern laboratories, the students are well equipped to get into core industries and/or higher studies in India and abroad.

Our Board of Studies involves experts from IISc, HAL, ISRO, DRDO and our alumni giving inputs to the curriculum design and modifications. The department has an MoU with Mitsubishi Electric India Private Limited, Schneider Electric India Private Limited and S M Electronic Technologies Private Limited. The department has externally funded research project and has several consultancy projects and linkages with industries. Consultancy projects are in the areas of internet of things (IoT), PLC based pneumatic and hydraulic experimental setup, low cost accessories for biomedical devices, and automation. The department also has an active membership in International Society of Automation (ISA) and the Society of Instrumentation Professionals (ISOI -IISc).

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio-economic needs

MISSION OF THE INSTITUTE

RIT shall meet the global socio-economic needs through

- Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization.
- Establishing research clusters in emerging areas in collaboration with globally reputed organizations.
- Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs.

QUALITY POLICY

We at Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned.

VISION OF THE DEPARTMENT

To become centre of excellence in the field of Electronics and Instrumentation Engineering for education and research.

MISSION OF THE DEPARTMENT

To empower and imbibe students with technical knowledge and practical skills in the field of Electronics and Instrumentation Engineering, enabling them to work as professionals in globally competitive environment and contribute to the society through research and higher studies.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

Graduates of EIE are able to

PEO 1: Demonstrate technical competency in the core areas of electronics & Instrumentation to excel in the respective industrial and research sectors.

PEO 2: Develop solutions for the global challenges in the field of sensors, signal and image processing, embedded systems, control and automation, in their diverse careers.

PEO 3: Exhibit professional attitude, leadership, and project management skills to work effectively in a multidisciplinary team for sustainable development.

PROGRAM OUTCOMES (POs):

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact ofthe professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO1: Demonstrate technical competency in measurements, instrumentation and automation domains for industrial and research sectors.

PSO2: Apply sensors knowledge and electronics principles for problem analysis, design and development of solutions.

PSO3: Implement appropriate engineering practices and state of the art technology tools for Electronics and Instrumentation domain.

SCHEME OF TEACHING

III SEMESTER

Sl. No.	Course Code	Course Name	Teaching Dept.	Category	Credits				Contact Hours
					L	T	P	Total	
1	EI31	Transform Techniques and Linear Programming	MATH	BSC	2	1	0	3	4
2	EI32	Analog Electronic Circuits	EIE	IPCC	3	0	1	4	5
3	EI33	Network Analysis	EIE	PCC	2	1	0	3	3
4	EI34	Logic Design	EIE	PCC	3	0	0	3	4
5	EI35	Measurement and Instrumentation	EIE	PCC	3	0	0	3	3
6	EIL36	Logic Design Lab	EIE	PCC	0	0	1	1	2
7	EIL37	Measurement and Instrumentation Lab	EIE	PCC	0	0	1	1	2
8	UHV38	Universal Human Values	EIE	UHV	2	0	0	2	2
9	EIAEC39	Engineering Aptitude	EIE	AEC	1	0	0	1	1
				Total	**16**	**2**	**3**	**21**	**26**
10	PE83/ YO83/ NS83	Physical Education Yoga NSS		NCMC				(Pass/ Fail)	
11	AM31	Additional Mathematics - I *****	MAT	--	0	0	0	0	3

Nomenclature: BSC: Basic Science Course**, IPCC:** Integrated Professional Core Course**, PCC:** Professional Core Course**,**
HSMC: Humanity and Social Science & Management Courses**, AEC–**Ability Enhancement Courses**, UHV:** Universal Human Value Course, **NCMC**: Non-credit Mandatory Course

L –Lecture, T – Tutorial, P- Practical/ Drawing

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with practical of the same course. Credit for IPCC is 03 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 1). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated only by CIE (no SEE). However, questions from the practical part of IPCC can be included in the SEE question paper.

The Non Credit Mandatory Course, Physical Education (Sport and Athletics)/Yoga/National Service Scheme (NSS):

1. Student shall select any one of the NCMC's namely, Physical Education (Sport and Athletics)/Yoga/ NSS prescribed for VIII semesters and shall attend the course from the III semesters and upto end of VIII semesters to complete all the formalities of the course and appear for the SEE. Marks scored in SEE shall be included in the VIII semester grade card.
2. The above mentioned NCMC's shall not be considered for vertical progression as well as for the calculation of SGPA/CGPA but completion of the courses shall be mandatory for the award of degree.
3. SEE marks will be allotted by the concerned course teacher based on attendance and performance in the practice sessions/field in the ratio of 50:50. Maximum CIE marks are 50. SEE should be awarded by the course teacher every semester (III to VIII) for 50 marks and marks scored by the student are scaled down to 50 in the VIII semester.
4. The students who take a course on Physical Education and Yoga, he/she has to take up the semester end practical examination prescribed for 100 marks. The students who opt for NSS course have to submit report and attend viva-voce examination. The marks of the report shall be 50 marks and for the presentation/viva-voce 50 marks. SEE scale down to 50 marks.
5. In case, any student fails to secure the minimum 40% of the prescribed marks, he/she shall be deemed to have secured **'F'** grade.

*** Lateral Entry Students:**

The Non-Credit Mandatory Course, Additional Mathematics I is prescribed for III Semester Lateral Entry Diploma students admitted to III Semester of BE Program. The student shall register for this course along with other III semester courses. The students shall attend classes for the course during the semester and complete all formalities of attendance and CIE. In case, any student fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured **'F'** grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE. Incase student fails to register for the said course/ falls short of attendance, he/she will repeat the course whenever it is offered next. Additional Mathematics I shall have CIE component only and no SEE component. This Course shall not be considered for vertical progression, but completion shall be mandatory for the award of the degree.

Inter/Intra Institutional Internship: All the students admitted under lateral entry category shall have to undergo a mandatory summer Internship-I of 03 weeks during the intervening vacation of III and IV semesters. Summer Internship shall include Inter / Intra Institutional activities. A Viva-voce examination shall be conducted during IV semester and the prescribed credit shall be included in IV semester after students clearing this head. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements during subsequent semesters.

Lateral Entry Students:

AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):

Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years degree program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students VIII semester grade card. The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. Incase student fail to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

SCHEME OF TEACHING

IV SEMESTER

Sl. No.	Course Code	Course Name	Teaching Dept.	Category	Credits				Contact Hours
					L	T	P	Total	
1	EI41	Numerical Methods and Probability Models	MATH	BSC	2	1	0	3	4
2	EI42	Control Systems	EIE	IPCC	3	0	1	3	4
3	EI43	Processor Architecture and Embedded Controllers	EIE	PCC	3	0	0	3	3
4	EI44	Process Instrumentation	EIE	PCC	3	0	0	3	3
5	EI45	Digital Signal Processing	EIE	PCC	2	1	0	3	4
6	EIL46	Digital Signal Processing Lab	EIE	PCC	0	0	1	1	2
7	EIL47	Processor Architecture and Embedded Controllers Lab	EIE	PCC	0	0	1	1	2
8	EIL48	Process Instrumentation Lab	EIE	PCC	0	0	1	1	2
9	EIAEC49	Biology for Engineers	EIE	AEC	1	0	0	1	1
10	INT410	Inter/ Intra institutional internship	EIE	INT	0	0	2	2	-
				Total	**14**	**2**	**6**	**22**	**26**
11	AM41	Additional Mathematics II *****	MATH	--	0	0	0	0	3

Nomenclature: BSC: Basic Science Course**, IPCC:** Integrated Professional Core Course**, PCC:** Professional Core Course**, INT –**Internship**, HSMC:** Humanity and Social Science & Management Courses**, AEC–**Ability Enhancement Courses, **NCMC**: Non-credit Mandatory Course
L –Lecture, T – Tutorial, P- Practical/ Drawing

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with practical of the same course. Credit for IPCC is 03 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 1). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated only by CIE (no SEE). However, questions from the practical part of IPCC can be included in the SEE question paper.
Innovation/ Societal/ Entrepreneurship based Internship: At the End of fourth Semester four - weeks summer internship shall be carried out at industry, State and Central Govt./NGO/MSME, Innovation centre's or incubation centres. The internship can be Rural Internship. All the students shall have to undergo mandatory internship of 04 weeks during the intervening period of IV & V semesters. A Viva-Voce examination (CIE) shall be conducted during V semester and the prescribed credit shall be included in VI semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements. The in-charge faculty has to monitor the student's internship progress and interact to guide them for the successful completion of the internship. Innovation/ Societal/ Entrepreneurship based Internship shall have only CIE no SEE component.
*** Lateral Entry Students:** **The Non-Credit Mandatory Course, Additional Mathematics II** is prescribed for IV Semester Lateral Entry Diploma students admitted to III Semester of BE Program. The student shall register for this course along with other IV semester courses. The students shall attend classes for the course during the semester and complete all formalities of attendance and CIE. In case, any student fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfil the requirements during subsequent semester/s to appear for CIE. In case student fails to register for the said course/ falls short of attendance, he/she will repeat the course whenever it is offered next. Additional Mathematics II shall have CIE component only and no SEE component. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of the degree.

AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):

Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years' degree program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students VIII semester grade card. The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case student fail to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

III Semester

TRANSFORM TECHNIQUES AND LINEAR PROGRAMMING	
Course Code: EI31	**Credits:** 2:1:0
Pre – requisites: Nil	**Contact Hours:** 28L+14T
Course Coordinator: Dr. Monica Anand & Dr. M. Girinath Reddy	

Course Content

Unit I

Laplace Transform: Definition, Transform of standard functions, Properties of Laplace transforms, Existence conditions, Transforms of derivatives, Integrals, Multiplication by t^n, Division by t, Evaluation of integrals by Laplace transforms and Transform of Periodic function.

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://nptel.ac.in/courses/111/105/111105134/
- Impartus recording: https://a.impartus.com/ilc/#/course/59742/295

Unit II

Applications of Laplace Transform: Unit–step function, Unit–impulse function. Inverse transforms, Convolution Theorem, Solution of linear differential equations and Simultaneous linear differential equations using Laplace transforms. Engineering applications.

- Pedagogy / Course delivery tools: Chalk and talk.
- Links: https://nptel.ac.in/courses/111/105/111105134/
- Impartus Recording: https://a.impartus.com/ilc/#/course/59742/295

Unit III

Fourier Series: Periodic functions, Dirichlet's conditions, Fourier series of periodic functions of period 2π and arbitrary period, Half range Fourier series, Practical harmonic analysis.

- Pedagogy / Course delivery tools: Chalk and talk.
- Links: https://nptel.ac.in/courses/111/105/111105134/
- Impartus Recording: https://a.impartus.com/ilc/#/course/619570/1030

Unit IV

Fourier Transforms: Derivation of Fourier series to Fourier transforms, Infinite Fourier transform, Infinite Fourier sine and cosine transforms, Properties, Inverse

transforms, Convolution theorem (without proof) and its significance, Parseval's identity (statements only), Fourier transform of derivatives and integrals, Solution of ODE's using Fourier transforms. Limitations of Fourier transform and need of Wavelet transform.

- Pedagogy / Course delivery tools: Chalk and talk.
- Links: https://nptel.ac.in/courses/111/105/111105134/
- Impartus Recording: https://a.impartus.com/ilc/#/course/171952/703

Unit V

Linear Programming: Introduction to Linear Programming Problem (LPP), Formulation of the problem, Graphical method, General, Canonical and standard forms of LPP, Simplex method, Big-M method, Two-phase simplex method and Duality in linear programming.

- Pedagogy / Course delivery tools: Chalk and talk.
- Links: https://nptel.ac.in/courses/111104027

Text Books:

1. Erwin Kreyszig –Advanced Engineering Mathematics – Wiley publication – 10th edition-2015.
2. B. S. Grewal –Higher Engineering Mathematics – Khanna Publishers – 44th edition – 2017.

References:

1. Glyn James – Advanced Modern Engineering Mathematics – Pearson Education – 4th edition – 2010.
2. Dennis G. Zill, Michael R. Cullen - Advanced Engineering Mathematics, Jones andBarlett Publishers Inc. – 3rd edition – 2009.
3. Kanti Swarup, P.K. Gupta and Man Mohan -Operations Research-Sultan Chand & Sons Publishers–2014.

Course Outcomes (COs):

At the end of the course the student will be able to

1. Determine Laplace transform of standard functions. (PO-1, PO-2, PSO-1, PSO-3)
2. Solve initial and boundary value problems using Laplace transforms. (PO-1, PO-2, PSO-1, PSO-3)
3. Construct the Fourier series expansion of a function/tabulated data. (PO-1, PO-2, PSO-1, PSO-3)

4. Evaluate Fourier transforms of functions and use it to solve ODE's. (PO-1, PO-2, PSO-1, PSO-3)
5. Formulate and solve a simple linear programming problem. (PO-1, PO-2, PSO-1, PSO-3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
Semester End Examination (SEE) (Scaled to 50 marks)	100	CO1, CO2, CO3, CO4, CO5

ANALOG ELECTRONIC CIRCUITS	
Course Code: EI32	**Credits:** 3:0:1
Pre – requisites: Basic Electronics (EC15)	**Contact Hours:** 42L+14P
Course Coordinator: Dr. Pushpa M K	

Course Content

Unit I

Introduction to analog electronics: Scope and applications of analog electronics, Construction and working principle, characteristics of JFET, Comparison of JFET and BJT, Biasing of JFET, JFET small signal model, Analysis of FET Common source amplifier with bypassed Rs and unbypassed Rs.

- Pedagogy/Course delivery tools: Chalk and Talk, PowerPoint presentation
- Impartus recording: http://a.impartus.com/ilc/#/course/81455/295

Unit II

Parameters of OP-amps: Characteristics of OPAMP -I/P resistance, O/P resistance, CMRR, slew rate, open loop voltage gain, Bandwidth, input offset voltage, input offset current, Bias current.

Op-amp Applications: Basic circuits, Differential amplifier with one opamp, Instrumentation amplifiers, V to I converters- Floating load and grounded load, Comparators. Schmitt trigger circuit, ZCD. Square wave generator using Schmitt trigger.

- Pedagogy/Course delivery tools: Chalk and Talk, PowerPoint presentation
- Impartus recording: http://a.impartus.com/ilc/#/course/81455/295

Unit III

Active Filters using Op-amps: Comparison of Active & Passive filters, I order Butterworth Low Pass Filter, High Pass Filter, Band Pass Filter and Band Elimination Filter**.**

Oscillators using Op-amp: Principles of Oscillators, RC phase shift oscillator, wein bridge oscillator. Design of RC phase shift and wein bridge oscillator.

- Pedagogy/Course delivery tools: Chalk and Talk, PowerPoint presentation
- Impartus recording: http://a.impartus.com/ilc/#/course/81455/295

Unit IV

555 Timer and Applications: Functional block diagram of 555 timer, Monostable multivibrator and its apllications, Astable multivibrator and applications. Function generator using 8038 IC -block diagram.

PLL (565 PLL): Basic principle of PLL, Phase detectors, Applications of PLL as multiplier/divider, FSK generator and PLL as FSK demodulator.

- Pedagogy/Course delivery tools: Chalk and Talk, PowerPoint presentation
- Impartus recording: http://a.impartus.com/ilc/#/course/81455/295

Unit V

Data Converters: Sample and Hold circuit and its specifications, **DAC:** Introduction, Classification, 4-bit Binary Weighted resistor DAC, 4 bit R-2R type DAC, **ADC**: Introduction, Classification of ADC – Ramp type ADC, 3 bit Successive approximation ADC, 3 bit Flash ADC.

- Pedagogy/Course delivery tools: Chalk and Talk, PowerPoint presentation
- Links: https://www.youtube.com/watch?v=zdMk2YpTmp0
  https://www.multisim.com/content/3VKrbHxokt9DyqU4tyygDb/3-bit-flash-adc/

Lab experiments:

1. Introduction to all measuring, source equipment's
2. Introduction to Software Simulator.
3. Integrator and Differentiator -simulation
4. V to I converters- Floating load and grounded load
5. Instrumentation amplifier- simulation
6. Schmitt trigger circuit.
7. Square wave generator using Schmitt trigger
8. II order Butterworth Low Pass Filter- simulation
9. II order Butterworth High Pass Filter -simulation
10. Wein bridge oscillator
11. Monostable multivibrator –simulation
12. 4 bit R-2R type DAC
13. 3 bit flash ADC - simulation

Text Books:

1. Ramakanth A Gayakwad, Opamps and Linear Integrated Circuits,4th Edition, PHI.
2. Robert L Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 9th Edition, PHI, 2006.

Reference Books:

1. MILLMAN - HALKIAS, Integrated Electronics, 33rd reprint TMH 1991.
2. Sergio Franco, Design with operational amplifiers and analog integrated circuits, 4th edition, Tata McGraw Hill.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Design amplifiers. (PO-1, PO-2, PO-3, PO-4, PSO-2)
2. Analyse various signal conditioning circuits. (PO-1, PO-2, PO-3, PO-4, PO-5, PSO-2)
3. Design filters and Oscillators. (PO-1, PO-2, PO-3, PO-4, PO-5, PSO-2)
4. Explain the operation of 555 Timer and PLL (PO-1, PO-2, PO-3, PO-4, PO-5, PSO-2)
5. Describe the operation and design Data converters. (PO-1, PO-2, PO-3, PO-4, PO-5, PSO-2)

Course Assessment and Evaluation:

Continuous Internal Evaluation: 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO2, CO3
Internal Test-II	30	CO1, CO4, CO5
Average of the two internal test shall be taken for 30 marks		
Other components		
Application on analog circuits - Lab Report	10	CO1 - CO5
Lab test.	10	CO1 - CO5
Semester End Examination (SEE) (Scaled to 50 marks)	**100**	CO1 - CO5

NETWORK ANALYSIS	
Course Code: EI33	**Credits:** 2:1:0
Pre – requisites: Basic Electrical Engineering (EE25)	**Contact Hours:** 28L+14T
Course Coordinator: Dr. K M Vanitha	

Course Content

Unit I

Passive Networks: V-I characteristics of idealized elements of networks, Sources: Independent (Ideal & practical), Dependent sources, Basic Laws (including Source transformation), Loop Analysis & Nodal Analysis with linearly dependent & independent sources for DC & AC networks (Concept of Super mesh & Super node), Star-Delta transformation, Duality in electrical networks.

- Pedagogy/Course delivery tools: Chalk and talk
- E Books: 1. Nptel.ac.in/courses/108105065- Networks signals and systems by Prof T.K. Basu, IIT Kharagpur. 2. Nptel.ac.in/courses/108102042- Circuit Theory by Prof Dutta Roy S.C, IIT Delhi 3. www.electrodiction.com/circuit-theory.
- MOOCs: 1. https://swayam.gov.in/nd1_noc19_ee36/preview
  2. http://elearning.vtu.ac.in/06ES34.html
  3. https://www.coursera.org/course/circuits

Unit II

Network Theorems: Superposition Theorem, Thevenin's & Norton's theorem, Maximum Power transfer theorem, Reciprocity & Millman's theorem.

- Pedagogy/Course delivery tools: Chalk and talk
- E Books: 1. Nptel.ac.in/courses/108105065- Networks signals and systems by Prof T.K. Basu, IIT Kharagpur. 2. Nptel.ac.in/courses/108102042- Circuit Theory by Prof Dutta Roy S.C, IIT Delhi 3. www.electrodiction.com/circuit-theory.
- MOOCs: 1. https://swayam.gov.in/nd1_noc19_ee36/preview
  2. http://elearning.vtu.ac.in/06ES34.html
  3. https://www.coursera.org/course/circuits

Unit III

Transient behavior and initial conditions: Behavior of circuit elements under switching condition & their representation, Evaluation of initial and final conditions in RL, RC and RLC circuits for DC & AC Excitation. **Resonant Circuits:** Series & Parallel resonance, Frequency response of Series & Parallel circuits.

- Pedagogy/Course delivery tools: Chalk and talk

- E Books: 1. Nptel.ac.in/courses/108105065- Networks signals and systems by Prof T.K. Basu, IIT Kharagpur. 2. Nptel.ac.in/courses/108102042- Circuit Theory by Prof Dutta Roy S.C, IIT Delhi 3. www.electrodiction.com/circuit-theory.
- MOOCs: 1. https://swayam.gov.in/nd1_noc19_ee36/preview
  2. http://elearning.vtu.ac.in/06ES34.html
  3. https://www.coursera.org/course/circuits

Unit IV

Laplace Transformation and its Applications: Review of Laplace transforms, Initial & final value theorem, convolution theorem, Periodic & A periodic waveforms, Time response of Single-Port passive networks.

- Pedagogy/Course delivery tools: Chalk and talk
- E Books: 1. Nptel.ac.in/courses/108105065- Networks signals and systems by Prof T.K. Basu, IIT Kharagpur. 2. Nptel.ac.in/courses/108102042- Circuit Theory by Prof Dutta Roy S.C, IIT Delhi 3. www.electrodiction.com/circuit-theory.
- MOOCs: 1. https://swayam.gov.in/nd1_noc19_ee36/preview
  2. http://elearning.vtu.ac.in/06ES34.html
  3. https://www.coursera.org/course/circuits

Unit V

Two Port Networks: Definition of Z, Y, h & T parameters, Modeling with these parameters, Relationships b/n 2 port n/w parameters, Interconnection of 2 port networks.

- Pedagogy/Course delivery tools: Chalk and talk
- E Books: 1. Nptel.ac.in/courses/108105065- Networks signals and systems by Prof T.K. Basu, IIT Kharagpur. 2. Nptel.ac.in/courses/108102042- Circuit Theory by Prof Dutta Roy S.C, IIT Delhi 3. www.electrodiction.com/circuit-theory.
- MOOCs: 1. https://swayam.gov.in/nd1_noc19_ee36/preview
  2. http://elearning.vtu.ac.in/06ES34.html
  3. https://www.coursera.org/course/circuits

Text Books:

1. N.O. Sadiku, Charles K. Alexander & Matthew, Fundamentals of Electric Circuits, 7th Edition, TMH publishers,2022
2. Hayt, Kemmerley and Durbin, Engineering Circuit Analysis, TMH 8th Edition, 2015

References Books:

1. M.E. Van Valkenburg, Network analysis, PHI/Pearson Education, 3rd Edition, reprint 2002
2. David K. Cheng, Analysis of Linear Systems, Narosa Publishing House, 11th reprint, 2002
3. Bruce Carlson, Circuits, Thomson Learning, 2000. reprint 2002

Course Outcomes (COs):

At the end of the course, students will be able to

1. Apply basic electrical laws and reduction techniques to linear circuits. (PO-1, PO-2, PSO-1)
2. Apply network theorems to simplify electric circuits. (PO-1, PO-2, PSO-1)
3. Analyze transient behavior of electric circuits and resonance conditions. (PO-1, PO-2, PSO-1)
4. Use Laplace transform to analyze electric circuits. (PO-1, PO-2, PSO-1)
5. Compute the two port network parameters. (PO-1, PO-2, PSO-1)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal test shall be taken for 30 marks		
Other components		
Quiz	10	CO1 - CO5
Assignment	10	CO1 - CO5
Semester End Examination (SEE) (Scaled to 50 marks)	**100**	CO1 - CO5

LOGIC DESIGN	
Course Code: EI34	**Credits:** 3:0:0
Pre – requisites: Basic Electronics (EC15)	**Contact Hours:** 42L
Course Coordinator: Dr. M. Jyothirmayi	

Course Content

Unit I

Introduction to Combination Logic: Review of Boolean algebra, SOP POS forms, K-maps (up to 4 variables), Map entered variables. **Introduction to Verilog:** Structure of Verilog module, Operators, data types, Styles of description- Data flow description, Behavioral description.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://nptel.ac.in/courses/108106177 (week 2, 3)
- Online tool & Open source software: https://circuitverse.org/simulator (both hardware and verilog)
- Impartus recording: http://a.impartus.com/ilc/#/course/81456/295

Unit II

Combinational Functions: Arithmetic Operations Adders: parallel adders, serial, Fast adders, and Subtractor: - using 1's and 2's compliment, Comparators – 2 bit and four bit, two bit Multiplier, Verilog Description for above circuits. **Multiplexers**- Realization of 2:1, 4:1 and 8:1 using gates & Applications. **Demultiplexers**: - Realization of 1:2, 1:4 and 1:8 using basic gates & Applications, Verilog description of Multiplexers and Demultiplexers.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://nptel.ac.in/courses/108106177 (week 5,6)
- Online tool & Open source software: https://circuitverse.org/simulator (both hardware and verilog)
- Impartus recording: http://a.impartus.com/ilc/#/course/81456/295

Unit III

Encoding and Decoding Codes: Binary coded decimal codes, Binary – Gray vice versa, Binary – Excess 3; Encoders and Priority Encoders, Decoders: BCD – Seven segment, Seven segment display. Programmable Logic Devices: PLA, PAL Verilog description for code converters and Encoders.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://nptel.ac.in/courses/108106177
- Online tool & Open source software: https://circuitverse.org/simulator (both hardware and verilog)

- Impartus recording: http://a.impartus.com/ilc/#/course/81456/295

Unit IV

Sequential Logic Circuits: Review of Latches and Flip-Flops: SR-latch, D-latch, D flip-flop, JK flip-flop, T flip- flop Master slave FF, Registers and Shift Registers: PISO, PIPO, SISO, SIPO, Right shift and left shift, Universal Shift register Ring and Johnson counters**. Counters, design and their applications**: Modulo N counters – Synchronous and Asynchronous counters.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://nptel.ac.in/courses/108106177 (week 7,8)
- Online tool & Open source software: https://circuitverse.org/simulator (both hardware and verilog)
- Impartus recording: http://a.impartus.com/ilc/#/course/81456/295

Unit V

FSM: Structure of Moore model and Mealy Model, Definition of state machines, Analysis of Clocked Synchronous sequential networks-excitation and output expressions, transition equations, transition tables, excitation tables, state tables, state diagrams, network terminal behavior, Example of a simple FSM circuit.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://nptel.ac.in/courses/108106177
- Impartus recording: http://a.impartus.com/ilc/#/course/81456/295

Text Books

1. Donald D Givone, Digital Principals and Design,12th reprint, TMH,2008
2. Morris Mano, Logic and Computer design fundamentals, 4th edition, PHI,2006
3. Nazeih M. Botros, HDL Programming VHDL And Verilog 2009 reprint, Dreamtech press.

References

1. Tocci, Digital systems principle & applications, 8thEdition, PHI 2004
2. Donald P Leach, Albert Paul, Malvino, Goutam Saha, Digital Principles and Applications, 6thEdition TMH, 2006.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Acquire knowledge and perform reduction of logic functions using simplification techniques. (PO-1, PO-2, PO-9, PSO-2, PSO-3)

2. Identify, analyze and design combinational circuits. (PO-1, PO-2, PO-3, PO-5, PO-9, PSO-2, PSO-3)
3. Write Verilog code using data flow and behavioral description. (PO-1, PO-2, PO- 3, PO-5, PO-9, PO-12, PSO-2, PSO-3)
4. Analyze and design various Sequential circuits. (PO-1, PO-2, PO3, PS-9, PO-12, PSO-2, PSO-3)
5. Use the concepts of state transition for analysis and design of synchronous and asynchronous sequential circuits. (PO-1, PO-2, PO-3, PO-9, PO-12, PSO-2, PSO-3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal test shall be taken for 30 marks		
Other components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO1 - CO5
Semester End Examination (SEE) (Scaled to 50 marks)	**100**	CO1-CO5

MEASUREMENT AND INSTRUMENTATION	
Course Code: EI35	**Credits:** 3:0:0
Pre – requisites: Engineering Physics (PY12)	**Contact Hours:** 42L
Course Coordinator: Dr. Christina Grace and Dr. H. S. Niranjana Murthy	

Course Content

Unit I

Introduction, Classification & Calibration: Introduction; Elements of measurement system; Instrument classification, Static Instrument characteristics; Dynamic Instrument characteristics; Calibration: Need, Principles, Control of environment, Traceability, One, two, three-point calibration; Errors: Sources of systematic error; Reduction of system error; Quantification, Random error, Statistical analysis, 6-sigma process

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation
- Links: https://youtu.be/hI9osda1ro8, https://youtu.be/Oo0jm1PPRuo

Unit II

Indicating, Recording and Display elements: Permanent Magnet Moving Coil instrument, Electronic multimeters, Digital Voltmeters, Digital LCR meter, Function generator, Cathode Ray Oscilloscopes (CRO), Digital Storage Oscilloscopes (DSO)

Data Acquisition Systems: Introduction to DAS – analog and digital, single and multichannel, Data loggers, Analog Switches and Multiplexers, Sampling fundamentals

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation
- Links: https://youtu.be/uxKyLTMv9js

Unit III

Distance, level and force measurement: Sensor and signal conditioning - Capacitive, Resistive, Inductive, Radar methods, Ultrasonic sensor, Laser Doppler, LIDAR, Force measurement basics & Electronic load cell

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation
- Virtual labs: http://slcoep.vlabs.ac.in/Capacitance/capacitance.html, http://slcoep.vlabs.ac.in/LinearVariableDifferntialTransformer/lvdt.html

Unit IV

Pressure and Vibration measurement: Strain gauges – Introduction, Derivation, Types; Diaphragm and Strain gauges for pressure measurement; High pressure and

Vacuum pressure measurement; Differential pressure measurement; Vibration measurement: Introduction, Proximity sensor, Velocity pick up, Accelerometer

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation
- Links: https://youtu.be/zS77qnlEPg0

Unit V

Temperature measurement: General principles of temperature measurement, Resistance temperature Detector, Thermocouple, Thermistor, Junction Semiconductor temperature sensors & signal conditioning, Optical pyrometer and bolometers – principles, types and working

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation
- Links: https://youtu.be/PccE4WcfnAw

Text Books:

1. Measurement and Instrumentation: Theory and Application, Second edition, Alan S. Morris, Reza Langari, Elsevier publication, 2016
2. Instrumentation Measurement and Analysis: B C Nakra and KK Chaudhry, Tata McGraw Hill Education Private Limited, 4th Edition, 2016
3. "Modern Electronic Instrumentation and Measurement Techniques", W.D. Cooper, PHI/Pearson, 2015

References:

1. John. P. Bentley, Principle of Measurement System, 3rd Edition, Pearson, 2007
2. N.E. Battikha, The condensed handbook of measurement and control, 4th Edition, ISA, 2018
3. D. Patranabis, Principles of Industrial Instrumentation, 2nd Edition, Tata McGraw Hill Education, 2008
4. Lessons In Industrial Instrumentation, by Tony R. Kuphaldt, Feb 2022, https://control.com/textbook/

Web links/ MOOC:

1. Selected topics in https://nptel.ac.in/courses/108105153
2. Selected topics in https://nptel.ac.in/courses/112107242
3. Selected topics in https://nptel.ac.in/courses/112103261

Course Outcomes (COs):

At the end of the course, students will be able to

1. Explain the theory and principles behind various measurement techniques. (PO-1, PO-9, PO-10, PO-12, PSO-1, PSO-2, PSO-3)
2. Describe the working principle and construction of various measuring instruments. (PO-1, PO-2, PO-9, PO-10, PSO-1, PSO-2, PSO-3)
3. Illustrate the importance, characteristics and advantages of measuring instruments for a given application. (PO-1, PO-2, PO-3, PSO-1, PSO-2)
4. Estimate for output or input variables of measuring instruments for a given condition. (PO-1, PO-2, PO-3, PO-4, PSO-1, PSO-2)
5. Design signal conditioning circuits for measuring instruments. (PO-1, PO-2, PO-3, PSO-1, PSO-2)

Course Assessment and Evaluation:

Continuous Internal Evaluation CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO2, CO4, CO5
Internal Test-II	30	CO1, CO3, CO4
Average of the two internal test shall be taken for 30 marks		
Other components		
Report on technical paper	10	CO1, CO2, CO3
Assignment	10	CO1 - CO5
Semester End Examination (SEE) (Scaled to 50 marks)	**100**	CO1-CO5

LOGIC DESIGN LAB	
Course Code: EIL36	**Credits:** 0:0:1
Pre – requisites: Basic Electronics (EC15)	**Contact Hours:** 14P
Course Coordinator: Dr. Jyothirmayi	

List of Experiments

Part-A: Hardware

1. Realization of Boolean expressions, half and full adder/full subtractor using NAND gates
2. Parallel Adder/ Subtractor using IC 7483
3. Multiplexer/ Demultiplexer: Use IC 74153, 74139 and solve Boolean expressions
4. Comparators using IC 7485, seven segment display
5. Flip flops, Shift registers, ring and Johnson counters
6. Counters using IC7493/ 74193
7. Asynchronous counters using Flipflops

Part-B: Software

Software Simulation, Implementation in Test bench and FPGA kit

1. Introduction to Xilinx ISE to create project, excute Verilog code, use test bench and down load to kit with Basic gates realization as an example.
2. Adders and Subtractors, Ripple carry adder using data flow description
3. Multiplexers using behavioral description (4:1, 8:1)
4. Encoders/ Decoders/ Priority encoders
5. Code converters and Comparators
6. Up and Down Counters; Shift Registers
7. Demo experiments on FSM machines
   - Students are required to perform 6 Hardware and 6 software prescribed experiments (from 2 to 7 in part A and B) in the above list.

Text Books:

1. Digital Design by Morris Mano
2. HDL with Digital Design VHDL & Verilog by N.Botros

Web links and Video Lectures (e-Resources):

1. https://circuitverse.org/simulator
2. http://vlabs.iitkgp.ac.in/dec/
3. http://vlabs.iitb.ac.in/vlabs-dev/labs/digital-electronics/index.html
4. http://www.verilog.com/
5. https://www.veripool.org/verilator/

Course Outcomes (COs):

At the end of the course, students will be able to

1. Design and implement combinational circuits. (PO-1, PO-2, PO-3, PO-5, PO-9, PO-10, PSO-1, PSO-3)
2. Design and implement different sequential circuits. PO-1, PO-2, PO-3, PO-5, PO-9, PO-10, PSO-1, PSO-3)
3. Realize combinational circuits, shift registers and counters using Verilog in FPGA kits. PO-1, PO-2, PO-3, PO-5, PO-9, PO-10, PSO-1, PSO-3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Weekly evaluation of laboratory records/ reports after the conduction of every experiment. Follow up and Viva	15 15	CO1, CO2, CO3
Practical test	20	CO1, CO2, CO3
Semester End Examination (SEE)	**50**	CO1, CO2, CO3

MEASUREMENT AND INSTRUMENTATION LAB	
Course Code: EIL37	**Credits:** 0:0:1
Pre – requisites: Engineering Physics (PY12)	**Contact Hours:** 14P
Course Coordinator: Dr. Christina Grace	

List of Experiments:

1. Linear and Angular displacement using capacitive transducer.
2. Displacement measurement using Potentiometer.
3. Displacement measurement using LVDT.
4. Strain gauge load cell.
5. Strain measurement using Cantilever beam.
6. Pressure transmitter/ transducer calibration.
7. Rough vacuum measurement using vacuum pressure transducer.
8. Displacement, Velocity and Acceleration measurement using Vibration sensor.
9. Temperature measurement with RTD.
10. Signal conditioning of Thermistor measurements.
11. Temperature measurement using AD595.
12. Current-type Temperature sensing using AD590.
13. Temperature and Distance measurement using IR sensor.
14. Absorbance measurement using optical sensors.

Text Book:

1. Measurement and Instrumentation: Theory and Application, Second edition, Alan S. Morris, Reza Langari, Elsevier publication, 2016
2. B.C.Nakra and N.K. Choudhary, Instrumentation Measurement and Analysis, Tata McGraw Hill Education, 4th Edition, 2016

Course Outcome (COs):

At the end of the course, students will be able to

1. Measure temperature, displacement, strain and pressure. (PO-1, PO-2, PO-3, PO-9, PO-10, PSO-1, PSO-2, PSO-3)
2. Implement appropriate signal conditioning for various measuring instruments. (PO-1, PO-2, PO-3, PO-9, PO-10, PSO-1, PSO-2, PSO-3)
3. Analyze the performance characteristics of different measuring instruments. (PO-1, PO-2, PO-3, PO-9, PO-10, PSO-1, PSO-2, PSO-3)

Course Assessment and Evaluation:

Continuous Internal Evaluation CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Weekly evaluation of laboratory records/ reports after the conduction of every experiment. Follow up and Viva	20 10	CO1, CO2, CO3
Practical test	20	CO1, CO2, CO3
Semester End Examination (SEE)	**50**	CO1, CO2, CO3

UNIVERSAL HUMAN VALUES	
Course Code: UHV38	**Credits:** 2:0:0
Pre – requisites: Nil	**Contact Hours:** 28L
Course Coordinator: Dr. H. S. Niranjana Murthy	

Course content

Unit I

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration
- Links: Holistic Development and Role of Education https://youtu.be/sGZtTPe-lhQ

Unit II

Understanding Harmony in the Human Being - Harmony in Myself!

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
2. Understanding the needs of Self ('I') and 'Body' - *Sukh* and *Suvidha*
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I'
5. Understanding the harmony of I with the Body: *Sanyam* and *Swasthya*; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure *Sanyam* and *Swasthya*

Practice Exercises and Case Studies will be taken up in Practice Sessions.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration
- Links: Harmony in Human Being- Self and Body https://youtu.be/0ERSMkRPQBM
  Links: Harmony in Human Being- Self https://youtu.be/83oGJ4oDeIg
  Links: Harmony between Self and Body Prosperity https://youtu.be/aJ_BU2OgpKs

Unit III

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1. *Understanding Harmony in the family – the basic unit of human interaction*
2. Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*;
3. Trust (*Vishwas)* and Respect (*Samman)* as the foundational values of relationship
4. Understanding the meaning of *Vishwas*; Difference between intention and competence
5. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship
6. Understanding the harmony in the society (society being an extension of family):
7. *Samadhan, Samridhi, Abhay, Sah-astitva* as comprehensive Human Goals
8. Visualizing a universal harmonious order in society- Undivided Society (*Akhand Samaj),* Universal Order (*Sarvabhaum Vyawastha)*- from family to world family!

Practice Exercises and Case Studies will be taken up in Practice Sessions.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration
- Links: Harmony in Family- Trust https://youtu.be/F2KVW4WNnS8
  Links: Harmony in family- Respecthttps://youtu.be/iLqNRPuv0_8
  Links: Harmony in family- Other Feeling Justice https://youtu.be/TcYJB7reKnM
  Links: Harmony in the Society https://youtu.be/BkWgFinrnPw

Unit IV

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature

3. Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space
4. Holistic perception of harmony at all levels of existence

Practice Exercises and Case Studies will be taken up in Practice Sessions.

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration
- Links: Harmony in Nature https://youtu.be/K1Jpd_ojydw
- Links: Harmony in Existence https://youtu.be/mormUeZ_RUE

Unit V

Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics:
   A. Ability to utilize the professional competence for augmenting universal human order
   B. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
   C. Ability to identify and develop appropriate technologies and management patterns for above production systems.
5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order:
   A. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
   B. At the level of society: as mutually enriching institutions and organizations

Suggested Learning Resources:

- Pedagogy / Course delivery tools: Chalk and talk, Power point presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration

Text Books:

1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

Reference Books:

1. B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Publishers.
3. Sussan George, 1976, *How the Other Half Dies*, Penguin Press. Reprinted 1986, 1991
4. Ivan Illich, 1974, *Energy & Equity*, The Trinity Press, Worcester, and HarperCollins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.
6. Subhas Palekar, 2000, *How to practice Natural Farming*, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
7. A Nagraj, 1998, *Jeevan Vidya ek Parichay*, Divya Path Sansthan, Amarkantak.
8. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
9. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
2. https://www.youtube.com/watch?v=P4vjfE-YnVk&list=PLWDeKF97v9SP7wSlapZcQRrT7OH0ZlGC4
3. **Course handouts:** https://drive.google.com/drive/folders/1zioX_4L2fCNX4Agw282PN86pcZZT3Osr?usp=sharing
4. **Presentation slides:** https://drive.google.com/drive/folders/1rMUKh1s0HPRBlpp_b1mpS-duNRcwS6YH?usp=sharing

Course Outcomes (COs):

At the end of the course, Students will be able to:

1. Apprehend the need of Value Education over Human aspirations (PO-6)
2. Assimilate Harmony over the physical needs and to overcome the self- needs for a prosperous life. (PO-6)
3. Recognize the need of Harmony in the Family and Society for a better World. (PO-6)
4. Explain the need of mutual understanding for Holistic Harmony in all the Levels of Human Existence. (PO-6)
5. Explain the Holistic understanding of Harmony and Professional Ethics at Individual Level and Society. (PO-6, PO-8)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE)		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests will be taken for 30 marks.		
Other components		
• Assignment • Quiz • Presentation • Model / mini project • Any other	20 (10 + 10)	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE) Scaled to 50 Marks	100	CO1, CO2, CO3, CO4, CO5

ENGINEERING APTITUDE	
Course Code: EIAEC39	**Credits:** 1:0:0
Pre – requisites: Nil	**Contact Hours:** 14L
Course Coordinator: Dr. Christina Grace	

Course content:

Unit 1

Units and Dimensions: Fundamental and derived units, Characteristics of standard unit, Systems of units, basic and supplementary units, dimensional formulae, dimensional equation and applications.

- **Pedagogy / Course delivery tools**: Chalk and talk, Presentation, Self-study component
- **Links**: https://gppanchkula.ac.in/wp-content/uploads/2020/03/PHYSICS-LEARNING-MATERIAL.pdf (for unit 1)

Unit 2

Ratio, proportions and percentages: Ratio, Proportion, Partnership, Percentages, Concept of multiplying factors, Successive percentage change

- **Pedagogy / Course delivery tools**: Chalk and talk, Presentation
- **Links**: https://ilearn.fife.ac.uk/mod/page/view.php?id=60423

Unit 3

Set theory: Types of Set, Venn diagram of different Sets, Standard results based on Venn diagram, Algebraic law of sets, Numerical problems

Permutation and Combination: Fundamental principle of counting, Permutation, Combination, Difference between them, Numerical problems

- **Pedagogy / Course delivery tools**: Chalk and talk, Presentation
- **Links**: https://www.indiabix.com/verbal-reasoning/venn-diagrams/introduction, https://learn.saylor.org/mod/page/view.php?id=21578

Unit 4

Data interpretation: Introduction, Tables, Line graph, Bar graph, Pie charts, Double Pie charts, Combination of graphs

- **Pedagogy / Course delivery tools**: Presentation, Web links
- **Links**:www.delmarlearning.com/companions/content/0766816346/release3/web_chapter_3.pdf

Unit 5

Analytical Reasoning: Coding and Decoding – change in relative position, shifting of letters, coding letters to numbers, substitution-based coding, mixed number or mixed letter coding, Puzzles, Identification of the next pattern, Blood relationships, Seating arrangement

- **Pedagogy / Course delivery tools**: Chalk and talk, Presentation, Web links
- **Links**: https://www.kidzone.ws/puzzles/cryptogram/index.asp

Text book/s:

1. Engineering Aptitude (Quantitative Aptitude and Analytical Ability), IES Master Publication, First edition.
2. Quantitative Aptitude for Competitive Examinations by R S Aggarwal, Revised Edition, 2017, S Chand publication.

Reference book/s:

1. A Modern approach to Verbal and Non-Verbal Reasoning by R S Aggarwal, Revised Edition, 2007, S Chand publication

Web links:

1. https://gppanchkula.ac.in/wp-content/uploads/2020/03/PHYSICS-LEARNING-MATERIAL.pdf (for unit 1)
2. Aptitude Test and Preparation Android app: https://goo.gl/K4mpJ5
3. https://play.google.com/store/apps/details?id=com .lt.logicalreasoning

Course Outcomes:

At the end of the course, the student will be able to:

1. Estimate the dimensional formulae and the dimensional consistency of equations (PO1, PO2, PO12, PSO1)
2. Solve problems pertaining to ratio, proportions and percentages (PO1, PO2, PO3, PO12, PSO2)
3. Apply the knowledge of Set theory, Permutation and Combination to solve numerical problems (PO1, PO2, PO3, PO12, PSO2)
4. Interpret data presented in graphical form (PO1, PO2, PO5, PO10, PO12, PSO3)
5. Analytically reason and decode, solve puzzles and seating arrangement problems (PO1, PO2, PO3, PO9, PO10, PO12, PSO2)

Course Assessment and Evaluation:

Continuous Internal Evaluation: 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3-CO5
Average of the two internal test shall be taken for 30 marks		
Other components		
Quiz	10	CO1 - CO5
Assignment	10	CO1 - CO5
Semester End Examination:	**50**	CO1 - CO5

PHYSICAL EDUCATION	
Course Code: PE83	**Credits:** NCMC
Pre – requisites: Nil	
Course Coordinator: Dr. Kiran Kumar H K	

Course Learning Objectives:

1. To introduce students to the importance of physical fitness for success in any career.
2. To instill in them concepts of team spirit and team building
3. To develop positive thinking, goal setting and decision-making abilities under duress.
4. To harness values and skills like leadership, communication and sacrifice.
5. To inculcate in students, the ability to handle success and failures with equanimity.

Selection Process: A Student shall select any one of the following Sports based on his/her interest and the facility available. The details **of Sports Facilities available (both indoor and outdoor) at institute campus** are as below:

Outdoor Games		**Indoor Games**		**Athletics**	
Games	**No. of Students**	**Games**	**No. of Students**	**Events**	**No. of Students**
Volleyball	12 x 4 = 48	**Badminton**	30	**Sprint** - 100mt, 200mt, 400mt	60
Basketball	12 x 4 = 48	**Table Tennis**	30	**Middle distance running** – 800mt, 1,500mt	
Kabaddi	12 x 4 = 48	**Chess**	30	**Long distance running** – 5,000mt, 10,000mt	
Kho Kho	12 x 4 = 48	**Weight Training [Gym]**	35	**Jumping Events** – Long Jump Triple Jump High Jump	30
Throw ball	12 x 4 = 48			**Throwing Events** Shot Put Discuss Javelin	30
Football	16 x 4 = 64	**Note: Students should bring their own sports attires**			
Hockey	16 x 4 = 64				
Cricket	16 x 4 = 64				

Contact Sessions: A student shall abide by the following during the sessions scheduled in the semester.

Session 1

Fundamentals of Physical Education, value addition to personality through fitness education, discipline and team building activities, Orientation towards particular sports and skill training

Session 2

Formation of teams based on student's orientation and preference. Team practice and skill enhancement.

Session 3

Conduction of matches in all sporting events registered by Students. Evaluation of each student shall be based on their performance either in team or individual. The student representing the Institute at University/State/National/International Level will be awarded additional marks during evaluation.

Course Outcomes (COs):

1. Develop interest and skill in playing particular sports.
2. Understand the process of organizing sporting events.
3. Appreciate the role of fitness for a better lifestyle.
4. Derive lessons from sports activities for effective planning and discipline in Life.
5. Analyze situations and optimize end results.

Course Assessment & Evaluation:

1. A committee consisting of Sports Director and Coaches of respective Sports will be formed to observe and evaluate the students for CIE in each semester.
2. Students shall follow the schedules, rules and regulations as prescribed by the Committee.
3. Students shall mandatorily have 85% attendance to be eligible for evaluation.
4. All the Sessions and evaluation process will be common for all semesters of the academic year.
5. The final result will be reflected on the grade card of 8th Semester.
6. The final marks shall be calculated after scaling down CIE to 50 marks & combining with 50 marks for SEE.

YOGA	
Course Code: YO83	**Credits:** NCMC
Pre – requisites: Nil	
Course Coordinator: Dr. Hari Chandra B P & Dr. Parimala P	

Course Learning Objectives:

1. To introduce to the students, the fundamental theoretical aspects of yoga.
2. To inculcate in students a habit of practicing yoga.
3. To be able to demonstrate basic yoga asanas.
4. To be able to practice fundamental breathing practices and mudras.
5. To understand the relevance of yoga and research in modern times.

Course Content

Introduction: Definition of yoga, benefits, astangas of yoga, Relevance of yoga and yoga-research in modern times.

Asanas: Kriyathmakachalanas, Suryanamaskar, Superbrain yoga, Vrikshasana, Trikonasana, Veerabhadrasana, Paschimotasana, Purvothanasana, Bharadwajasana, Amruthasana, Parivruttha Trikonasana, Parsvakonasana, Ustrasana, Padmasana, Jaaanushirshasana, Navasana, Ardhachakrasana, Ardhakatichakrasana, Jataraparivarthanasana, Sethubandasana, Sarvangasana, Mathyasana, Dhanurasana, Shirshasana.

Pranayamas: Anuloma-Viloma, Suryanuloma, Chandranuloma, Brahmari, Suryanbedhana, Chandrabedhana, Sheetali, Seethkari, Sadantha, bastrika.

Mudras: Chinmudra-Jnanamudra, Praana mudra, panchaprana mudras, panchabhoota mudras, Pruthvi mudra, Shoonya mudra, Surya mudra, Jalodharanashaka mudra, Kundalini mudra, shoonyavaayu mudra, shakti mudra, sandhi mudra, vajra mudra and garuda mudra.

Course Outcomes (COs):

At the end of the course, a student will

1. Understand the fundamental and theoretical aspects of yoga.
2. Develop a habit of practicing yoga.
3. Demonstrate basic yoga asanas.
4. Demonstrate fundamental breathing practices.
5. Understand the relevance of yoga and its research in modern times.

Reference books:

1. Light on yoga, B K S Iyengar, Publisher -Thorsons, UK, 2006
2. Light on pranayama, B K S Iyengar, Publisher - Element; First Edition
3. The Essential Yoga Mudras for Healing, Dr. Aasoori K. Rangaraja Iyengar, Saranga Publishing; First Edition 2021

Pedagogy:
Chalk and talk, demonstration, videos, ppt.

Contact Sessions:

There would be one introduction class, and five contact classes in each semester.
The candidates shall practice yoga on a daily basis, or in the worst case on alternate days at their place of residence and maintain a short diary in the format provided by yoga teacher. The same shall be brought to the classes.

Online reference sources:

- Yoga for beginners part 1: https://www.youtube.com/watch?v=VwPeThpwfWI
- Yoga for beginners part 2: https://www.youtube.com/watch?v=s_pnJTcOp8A
- Suryanamaskar: https://www.youtube.com/watch?v=nUdlucNd6go&t=133s
- Yoga for anxiety and stress: https://www.youtube.com/watch?v=hJbRpHZr_d0
- Common yoga protocol: https://www.youtube.com/watch?v=Av5ib_XRKT4
- Relevance of yoga in modern times: www.youtube.com/watch?v=HUzBCts7BTo

Course Assessment & Evaluation:

1. A committee consisting of Yoga Instructors will be formed to observe and evaluate the students for CIE in each semester.
2. Students shall follow the schedules, rules, and regulations as prescribed by the Committee.
3. Students shall mandatorily have 85% attendance to be eligible for evaluation.
4. All the Sessions and evaluation processes will be common for all semesters of the academic year.
5. The final result will be reflected on the grade card of 8th Semester.
6. The final marks shall be calculated after scaling down CIE to 50 marks & combining it with 50 marks for SEE.

Scheme of SEE

Practical Demonstration	30 marks
Write-up	10 marks
Viva	10 marks
Total	**50 marks**

NATIONAL SERVICE SCHEME	
Course Code: NS83	**Credits:** NCMC
Pre – requisites: Nil	
Course Coordinator: Dr. Puttabore Gowda & Dr. Siddaraju C	

Course Learning Objectives:

1. To introduce students to the importance of national service
2. To harness values and skills like leadership, teamwork and sacrifice.
3. To serve society through educational services and health
4. To work towards rural and local development through technological services
5. To inculcate in students, the ability to handle socially relevant projects.

Students shall involve in activities related to national and regional technical and non-technical services, as listed below.

- Serving society by bringing awareness on education and cleanliness.
- Blood donation camps
- Developing technologies for rural masses.
- Conduction and participation in camps for a social cause.
- Educating towards health and well-being of individuals/society.
- Cultural and educational programs for society.
- Contributing towards the improvement of civil services and bringing certain shortcomings to the notice of higher authorities for suitable remedial actions.
- Contribution towards traffic management and other public services.
- Clean up and development of water sources around public places.
- Services during a disaster or other needy situations.
- Camps for the rejuvenation of lakes and water bodies.
- Serving nature and agriculture.
- Awareness programs on health and food adulteration.
- Presenting papers/talks in various fora on the above topics.
- Developing technologies for rural masses beyond academic requirements.
- Plantation programs.
- Conducting programs for self-sustainability, and human and national development.
- Contribution towards orphans and challenged individuals through well-recognized organizations.
- Carrying out designated activities in villages.
- Development and implementation of strategies for solid waste, E-waste etc.

- Education towards pollution control and traffic management.
- Production of documentaries and short films/videos for motivating people on any of the above causes.

Course Outcomes (COs):

At the end of the course, a student will be able to

1. Understand the importance of national service.
2. Gain skills like leadership and teamwork.
3. Volunteer towards educational services and health.
4. Contribute to rural and local development through technical services.
5. Comprehend socially relevant projects

Contact Sessions:

The students shall attend the review and contact sessions as scheduled by the course coordinator.

Course Assessment & Evaluation:

1. The candidates shall maintain a record of activities in a Diary, and get them endorsed during the contact sessions at least 3 times in a semester.
2. A detailed project report should be submitted during the last fortnight of the semester
3. Evaluation will be done during each semester based on the nature of the contribution.
4. The final marks shall be calculated after scaling down CIE to 50 marks & combining with 50 marks for SEE

ADDITIONAL MATHEMATICS – I	
Course Code: AM31	**Credits:** 0:0:0
Pre – requisites: Nil	**Contact Hours:** 42L
Course Coordinator: Dr. Shashi Prabha Gogate S	

Course Content

Unit I

Differential Calculus: Successive differentiation, nth derivatives of some standard functions, Leibnitz theorem, Polar curves. Angle between the radius vector and the tangent, angle between curves, length of the perpendicular from pole to the tangent, pedal equations. Taylor's and Maclaurin's expansions.

- Pedagogy/Course delivery tools: Chalk and Talk
- Links: https://nptel.ac.in/courses/111/105/111105121/ https://nptel.ac.in/courses/111/104/111104144/
- Impartus recording: https://a.impartus.com/ilc/#/course/107625/1030

Unit II

Integral Calculus: Introduction, Reduction formula, Reduction formula for $\int Sin^n x\ dx$, $\int Cos^n x\ dx$ and $\int Sin^n x\ Cos^m\ x\ dx$. Evaluation of double and triple integrals.

- Pedagogy/Course delivery tools: Chalk and Talk
- Links: https://nptel.ac.in/courses/111/105/111105121/
- https://a.impartus.com/ilc/#/course/107625/1030

Unit III

Vector Algebra: Scalar and vectors. Vector addition and subtraction. Multiplication of vectors (Dot and Cross products). Scalar and vector triple product-simple problems. Vector functions of a single variable. Derivative of a vector function, geometrical interpretation. Velocity and acceleration.

- Pedagogy/Course delivery tools: Chalk and Talk
- Links: https://nptel.ac.in/courses/111/105/111105134
- Impartus recording: https://a.impartus.com/ilc/#/course/107625/1030

Unit IV

Vector Differentiation: Scalar and vector fields, gradient of a scalar field, directional derivative, divergence of a vector field, solenoidal vector, curl of avector field,

irrotational vector. Laplace's operator. Vector identities connected with gradient, divergence and curl.

- Pedagogy/Course delivery tools: Chalk and Talk
- Links: https://nptel.ac.in/courses/111/105/111105134
- Impartus recording: https://a.impartus.com/ilc/#/course/107625/1030

Unit V

First Order Differential Equations: Solution of first order and first degree differential equations, variable separable methods, homogeneous equations, linear and Bernoulli's equations, exact differential equations.

- Pedagogy/Course delivery tools: Chalk and talk, Power Point Presentation
- Links: https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: https://a.impartus.com/ilc/#/course/59742/295

Text Books:

1. **B.S. Grewal** – Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
2. **Erwin Kreyszig** – Advanced Engineering Mathematics – Wiley Publication, 10th Edition, 2015.

Reference Books:

1. **H. K. Dass** – Higher Engineering Mathematics – S Chand Publications, 1998.
2. **B. V. Ramana** – Engineering Mathematics – Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2008.

Course Outcomes (COs):

At the end of the course the student will be able to

1. Solve problems related to nth derivative to some standard functions, polar curves and power series expansions.
2. Apply the concept of reduction formula to determine the length, area, volume of revolution of an arc of the curve.
3. Solve the problems related to velocity and acceleration.
4. Apply vector differentiation to identify solenoidal and irrotational vectors.
5. Apply the concept of various methods to solve first order first degree differential equations.

IV Semester

NUMERICAL METHODS AND PROBABILITY MODELS	
Course Code: EI41	**Credits:** 2:1:0
Pre – requisites: Nil	**Contact Hours:** 28L+14T
Course Coordinator: Dr. Monica Anand & Dr. M. Girinath Reddy	

Unit I

Finite Differences and Interpolation: Forward and backward differences, Interpolation, Newton-Gregory forward and backward interpolation formulae, Lagrange's interpolation formula and Newton's divided difference interpolation formula (no proof).

Numerical Differentiation and Numerical Integration: Derivatives using Newton-Gregory forward and backward interpolation formulae, Newton-Cotes quadrature formula, Trapezoidal rule, Simpson's $1/3^{rd}$ rule and Simpson's $3/8^{th}$ rule.

- Pedagogy / Course delivery tools: Chalk and talk.
- Links: https://nptel.ac.in/courses/111/105/111105134/
- Impartus Recording: https://a.impartus.com/ilc/#/course/96127/452

Unit II

Statistics: Curve fitting by the method of least squares, Fitting linear, quadratic and geometric curves. Correlation and Regression.

Random Variables and Discrete Probability Distributions: Random variables, Theoretical probability distributions, Mean and variance of random variables, Binomial and Poisson distributions.

- Pedagogy / Course delivery tools: Chalk and talk.
- Links: https://nptel.ac.in/courses/111/105/111105035/
- Impartus Recording: https://a.impartus.com/ilc/#/course/96127/452 https://a.impartus.com/ilc/#/course/619570/1030

Unit III

Continuous Probability Distributions: Uniform, Exponential, Normal and Gamma distributions.

Joint Probability Distributions: Joint and marginal probability distributions of discrete and continuous random variables, Covariance and Correlation of discrete and continuous random variables, Conditional probability distributions.

- Pedagogy / Course delivery tools: Chalk and talk.
- Links: https://nptel.ac.in/courses/111/105/111105035/
- Impartus Recording: https://a.impartus.com/ilc/#/course/96127/452

Unit IV

Stochastic Processes: Introduction, Classification of stochastic processes, Discrete time processes, Stationary stochastic processes, Autocorrelation, Ergodicity.

Markov Chain: Probability vectors, Stochastic matrices, Regular stochastic matrices, Markov processes, Markov chains, Higher transition probabilities, Stationary distribution of regular Markov chains and absorbing states.

- Pedagogy / Course delivery tools: Chalk and talk.
- Links: https://nptel.ac.in/courses/111103022
- Impartus Recording: https://a.impartus.com/ilc/#/course/96127/452

Unit V

Sampling and Statistical Inference: Sampling distributions, Concepts of standard error and confidence interval, Central Limit Theorem, Type I and Type II errors, Level of significance, One tailed and two tailed tests, Z-test: for single mean, for single proportion, for difference between means, Student's t –test: for single mean, for difference between two means, F – test: for equality of two variances, Chi-square test: for goodness of fit, for independence of attributes.

- Pedagogy / Course delivery tools: Chalk and talk.
- Links: https://nptel.ac.in/courses/111/105/111105035/
- Impartus Recording: https://a.impartus.com/ilc/#/course/96151/1112

Text Books:

1. Erwin Kreyszig –Advanced Engineering Mathematics – Wiley publication – 10th edition-2015.
2. B. S. Grewal – Higher Engineering Mathematics – Khanna Publishers – 44th edition – 2017.
3. Murray R Spiegel, John Schiller & R. Alu Srinivasan – Probability and Statistics – Schaum's outlines - 4nd edition-2013.

Reference Books:

1. R.E. Walpole, R. H. Myers, R. S. L. Myers and K. Ye – Probability and Statistics for Engineers and Scientists – Pearson Education – Delhi – 9th edition – 2012.
2. Glyn James – Advanced Modern Engineering Mathematics – Pearson Education – 4th edition – 2010.

Course Outcomes (COs):

At the end of the course the student will be able to

1. Find functional values, derivatives, areas and volumes numerically from a given data. (PO-1, PO-2, PSO-1)
2. Fit a least squares curve to a given data, analyze the given discrete random data and its probability distribution. (PO-1, PO-2, PSO-1)
3. Find parameters of continuous probability distributions and calculate the marginal and conditional distributions of bivariate random variables. (PO-1, PO-2, PSO-1)
4. Determine the parameters of stationary random processes and use Markov chain in prediction of future events. (PO-1, PO-2, PSO-1)
5. Choose an appropriate test of significance and make inference about the population from a sample. (PO-1, PO-2, PSO-1)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
Semester End Examination (SEE) (Scaled to 50 marks)	100	CO1, CO2, CO3, CO4, CO5

CONTROL SYSTEMS	
Course Code: EI42	**Credits:** 3:0:1
Pre – requisites: Network Analysis (EI33)	**Contact Hours:** 42L+14T
Course Coordinator: Dr. K M Vanitha	

Course Content

Unit I

Modeling of Systems: Types of Control Systems, Mathematical models of physical systems – Introduction- Differential equations of physical systems (Mechanical systems, Friction, Translational systems) (Mechanical accelerometer, Levered systems excluded), Mathematical models of Rotational systems- Gear trains, Analogous systems**. Block Diagrams and signal flow graphs:** Transfer functions, Block diagram algebra, Signal flow graphs (State variable formulation excluded)

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc17_ee12/preview
- MIT Open Course in Systems and Control, http://ocw.mit.edu/courses/mechanical-engineering/2-04a-systems-and-controls-spring-2013/
- Impartus recording: http://a.impartus.com/ilc/#/video/id/859549

Unit II

Time Response of feedback control systems: Standard test signals, Steady state errors and error constants, Unit step response of first and second order systems, Time response specifications of second order systems. P, PI, PD and PID compensation.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc17_ee12/preview
- MIT Open Course in Systems and Control, http://ocw.mit.edu/courses/mechanical-engineering/2-04a-systems-and-controls-spring-2013/
- Impartus recording: http://a.impartus.com/ilc/#/video/id/859549

Unit III

Stability Analysis: Concept of Stability, Routh –Hurwitz Criterion, Root Locus Technique, Construction of root locus, stability, Dominant poles.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc17_ee12/preview
- MIT Open Course in Systems and Control, http://ocw.mit.edu/courses/mechanical-engineering/2-04a-systems-and-controls-spring-2013/
- Impartus recording: http://a.impartus.com/ilc/#/video/id/859549

Unit IV

Frequency domain analysis: Correlation between time and frequency response, Frequency response -Bode plot, Polar plot, Frequency domain specifications from the plots.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc17_ee12/preview
- MIT Open Course in Systems and Control, http://ocw.mit.edu/courses/mechanical-engineering/2-04a-systems-and-controls-spring-2013/
- Impartus recording: http://a.impartus.com/ilc/#/video/id/859549

Unit V

Design of Feedback Control System: Approaches to system design**,** lead, lag, lead-lag compensator networks and example. Lead, lag, lead-lag compensator design using Bode and Root Locus Techniques

- Pedagogy/Course delivery tools: Chalk and talk

LIST OF EXPERIMENTS:

1. Introduction to MATLAB and using MATLAB for control systems.
2. Mathematical modeling of Physical systems.
3. Modeling of Physical systems using Simulink.
4. Block diagram Reduction.
5. Compute time response specifications for first and second order systems.
6. Introduction to PID controller.
7. Compute time response (through Root locus) and analyze system properties.
8. Compute frequency response (through Bode plots) and analyze system properties.
9. Design and implementation of RC Lead Compensator.
10. Design and implementation of RC Lag Compensator
11. Implementation of Lag¬ – Lead Compensator
12. Frequency response characteristics of first and second order system

Text Books:

1. J. Nagrath and M.Gopal, " Control Systems Engineering", New age International (P) Limited, Publishers, Fourth edition – 2007
2. "Modern Control engineering", K. OGATA, Pearson Education Asia/ PHI, 5th Edition
3. Ashish Tewari, Modern control Design with Matlab and Simulink, John Wiley, New Delhi, 2002.

Reference Books:

1. Richard C Dorf, Robert H Bishop, "Modern Control Systems",Addison Wesley Publishing ISBN:0-201-32677-9,2008
2. Farid and Kuo, Automatic control systems ,9th edition, John Wiley and sons.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Derive the transfer function and mathematical models of physical systems. (PO-1, PO-2, PO-5, PO-9, PO-10, PSO-1, PSO-2)
2. Determine transient and steady state behavior of the system. (PO-1, PO-2, PO-5, PO-9, PO-10, PSO-1, PSO-2)
3. Analyze the time domain stability of the system using RH criteria and root locus techniques. (PO-1, PO-2, PO-5, PO-9, PO-10, PSO-1, PSO-2)
4. Find the frequency domain specifications. (PO-1, PO-2, PO-5, PO-9, PO-10, PSO-1, PSO-2)
5. Design control system in time and frequency domain. (PO-1, PO-2, PO-5, PO-9, PO-10, PSO-1, PSO-2)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal test shall be taken for 30 marks		
Other components		
Quiz/ Assignment	10	CO1 - CO5
Lab experiments/ Assignments	10	CO1 - CO5
Semester End Examination (SEE) (Scaled to 50 marks)	**100**	CO1 - CO5

PROCESSOR ARCHITECTURE AND EMBEDDED CONTROLLERS	
Course Code: EI43	**Credits:** 3:0:0
Pre – requisites: Fundamentals of Computing (CS26)	**Contact Hours:** 42L
Course Coordinator: Dr. Elavaar Kuzhali. S	

Course Content

Unit I

Introduction: Introduction to Microprocessors and Microcontrollers, RISC vs CISC, ARM embedded systems: The RISC design philosophy, The ARM design philosophy, embedded system hardware, embedded system software. ARM Architecture. ARM processor fundamentals: Registers, current program status register, pipeline.

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for Introduction to ARM embedded systems
  https://nptel.ac.in/courses/117106111

Unit II

Introduction to ARM instruction set: Data Processing Instructions, Branch Instructions, Load Store Instructions, Software Interrupt Instruction, Program Status Register Instructions, Loading Constants and Conditional Execution.

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for ARM instruction set:
  http://103.170.244.45/~instrumentation/4th%20Semester/EI43
  https://nptel.ac.in/courses/117106111

Unit III

Introduction to the THUMB Instruction set: Thumb register Usage, ARM-Thumb Interworking, other branch instructions, Data Processing Instructions, Single register Load –store Instructions, Multiple register Load Store Instructions, Stack Instructions, and Software Interrupt Instruction.

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for THUMB instruction set:
  http://103.170.244.45/~instrumentation/4th%20Semester/EI43
  https://nptel.ac.in/courses/117106111

Unit IV

Interrupts & Exception Handling: Exceptions, Interrupts and vector table, Exception Handling Interrupts, Interrupt handling schemes- Non-Nested Interrupt Handler, Nested Interrupt Handler.

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for Interrupts & exception handling:
  http://103.170.244.45/~instrumentation/4th%20Semester/EI43
  https://nptel.ac.in/courses/117106111

Unit V

LPC 2148: Design of system using GPIO's (Interface to SWITCH, LED's, LCD interface, 4 x 4 Keypad), Timers, ADC, DAC, UART.

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for LPC2148 : http://103.170.244.45/~instrumentation/4th%20Semester/EI43
  https://www.nxp.com/docs/en/user-guide/UM10139.pdf

Text Books:

1. "Andrew N.Sloss", ARM system Developers Guide, Elsevier, 2008
2. "William Hohl", ARM Assembly Language: Fundamentals and Techniques, Second Edition, CRC Press, 2014

Reference Books:

1. "J.R.Gibson", ARM Assembly language An Introduction, Lulu.com, 2nd edition, 2011.
2. https://www.nxp.com/docs/en/user-guide/UM10139.pdf

Web links for video lectures (e-Resources):

1. https://nptel.ac.in/courses/117106111
2. http://103.170.244.45/~instrumentation/4th%20Semester/EI43/
3. http://103.170.244.45/~instrumentation/6th%20Semester/EI61(O)
4. Advanced%20Embedded%20Controllers/

Course Outcomes (COs):

At the end of the course, students will be able to

1. Understand the various aspects of ARM architecture (PO-1, PO-5, PSO-1)
2. Write programs using ARM instruction set. (PO-1, PO-2, PO-3, PO-5, PO-9, PO-10, PSO-1, PSO-3)
3. Write programs using THUMB instruction set. (PO-1, PO-2, PO-3, PO-5, PO-9, PO-10, PSO-1, PSO-3)

4. Analyze the various ways of handling exceptions and interrupts in ARM processor. (PO- 1, PO-2, PO-3, PO-5, PO-9, PO-10, PSO-1, PSO-3)
5. Write embedded C programs to interact with Built-in-Peripherals of ARM7-LPC2418. (PO- 1, PO-2, PO-3, PO-5, PO-9, PO-10, PSO-1, PSO-3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal test shall be taken for 30 marks		
Other components		
Quiz	10	CO1, CO2
Assignment/ Project	10	CO3,CO5
Semester End Examination (SEE) (Scaled to 50 marks)	**100**	CO1 - CO5

PROCESS INSTRUMENTATION	
Course Code: EI44	**Credits:** 3:0:0
Pre – requisites: Measurement and Instrumentation (EI35)	**Contact Hours:** 42L
Course Coordinator: Dr. J V Alamelu	

Course Content

Unit I

Basic Concept of Fluid Mechanics & Flow of Fluids: Introduction, properties of fluids, viscosity, fluids pressure at a point, properties, laws of pressure, types of fluids, types of fluid flow, rate of flow, equation of continuity, velocity and acceleration, types of motion, linear translation, deformation, angular deformation, rotation, vorticity, forced and free vortex flow.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://www.youtube.com/watch?v=fa0zHI6nLUo (NPTEL) https://nptel.ac.in/courses/112104118
- Impartus recording: https://a.impartus.com/ilc/#/course/2580504/1205

Unit II

Flow of Fluids: Dynamics of flow, equations of motion, Euler's equation, Bernoulli's equation. **Head Type & Quantity Flow meters**: Orifice plate, Venturi tube, Flow nozzle, Pitot tube, Positive displacement flow meters – nutating disc and reciprocation piston.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://www.youtube.com/watch?v=fa0zHI6nLUo (NPTEL) https://nptel.ac.in/courses/112104118
- Impartus recording: https://a.impartus.com/ilc/#/course/2580504/1205

Unit III

Area Flow meters & Mass Flow meters: Turbine flow meter, Rotameter, Coriolis mass flow meters, Thermal mass flow meter, Volume flow meter plus density measurement. **Electrical Type Flow Meter:** Electromagnetic flow meter – different types of excitation, schemes used, Ultrasonic flow meters, Vortex shedding flow meter, solid flow rate measurement, calibration of flow meters – dynamic weighing method.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://archive.nptel.ac.in/courses/108/105/108105064/
- Impartus recording: https://a.impartus.com/ilc/#/course/2580504/1205

Unit IV

pH and viscosity measurement: pH meters, conductivity measurements, Saybolt viscometer, Rotameter type viscometer, Suitable signal conditioners**.**

Humidity and Moisture: Definitions and basic theory, dry and wet bulb psychrometers, hot wire electrode type hygrometer, electrolysis type hygrometer, dew point meter, Different methods of moisture measurement.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://archive.nptel.ac.in/courses/108/105/108105064/
- Impartus recording: https://a.impartus.com/ilc/#/course/2580504/1205

Unit V

Micro sensors and Actuators: Introduction to MEMS, Bulk and surface micromachining, Cantilever beam type sensors, Comb type capacitive accelerometer, Micro actuator, Micro sensor integration and applications.

Instrument selection, Installation & Maintenance: Guidelines for selection of instruments, Data sheets handling, Ingression protection, Enclosures. Installation – P&ID diagram - checkout – lockout & tagout procedures. Maintenance – Implementation, Types, Records, Hazards, Electrical isolation.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://nptel.ac.in/courses/108108147/
- Impartus recording: https://a.impartus.com/ilc/#/course/2580504/1205

Text Books:

1. Bansal.R.K, Fluid Mechanics and Hydraulic Machines, Laxmi Publications, 2005.
2. E.O.Doebline, Measurement systems application and design, 4th Edition TMH.
3. D.Patranabis, Principles of Industrial Instrumentation 2nd Tata McGraw Hill

Reference Books:

1. Radhakrishnan, E., Introduction to fluid Mechanics, Prentice Hall, India 2005.
2. Rajput R.K.,Fluid Mechanics and Hydraulic Machines, S.Chand and Co., India.
3. John. P. Bentley, Principle of Measurement System, 3rd Edition, Pearson 2007. Bela .G. Liptak, Process Measurement.
4. N.E. Battikha, The condensed handbook of measurement and control, 4th Edition, ISA, 2018
5. Tai-Ran Hsu, MEMS And Microsystems: Design and Manufacture, 2017, Tata McGraw-Hill Education.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Describe the physical principles of fluid mechanics applied in process instrumentation. (PO-1, PO-2, PO-3, PSO- 1, PSO-2)
2. Explain the working principle of flow, pH, viscosity, Humidity and moisture and MEMS based measurements. (PO-1, PO-2, PO-3, PO-6, PO-7, PSO- 1, PSO-2)
3. Apply fluid mechanics and instrumentation concepts to solve numerical problems. (PO-1, PO-2, PO-3, PSO- 1, PSO-2)
4. Design suitable schematic for measurements, and signal conditioning circuits for sensors. (PO-1, PO-2, PO-3, PO-10, PO-12, PSO-1, PSO-2)
5. Elucidate important features and calibration, installation procedures for different types of instruments. (PO-3, PO-6, PO-7, PO-12, PSO-1, PSO-2, PSO-3)

Course Assessment and Evaluation:

Continuous Internal Evaluation CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal test shall be taken for 30 marks		
Other components		
Quiz	10	CO1 - CO5
Assignment	10	CO1 - CO5
Semester End Examination (SEE) (Scaled to 50 marks)	**100**	CO1 - CO5

DIGITAL SIGNAL PROCESSING	
Course Code: EI45	**Credits:** 2:1:0
Pre – requisites: Engg. Mathematics I & II (MA11 & MA21)	**Contact Hours:** 28L+14T
Course Coordinator: Dr. Shivaprakash G	

Course Content

Unit I

Introduction: Signals and Systems, Classification of Signals: Continuous & discrete, deterministic and random signals, Odd and even signals, Periodic & aperiodic signals, Causal & Non-causal, Power & Energy signal, Real and complex signals. Even and odd decomposition of signals.

Operation on signals: Operation on independent variables, Operations on dependent variable, precedence rule. Elementary CT signals: Unit step, ramp, impulse, exponential signal and sinusoidal signals. Elementary DT signals: Unit step, ramp, impulse, exponential signal and sinusoidal signals. Systems classification, Identification of system type using Impulse response of the system and its properties [1].

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://nptel.ac.in/courses/108104100 (Signals and classifications, Prof. Aditya K. Jagannatham, IIT Kanpur). Lectures-1 to 9. Can download from the download tab.
  https://nptel.ac.in/courses/108106151(DSP, C. S. Ramalingam, IIT Madras). First 14 videos under the download link.
- Impartus recording: https://a.impartus.com/ilc/#/course/59757/295 (signals processing)

Unit II

DTFT representation of signals and properties of DTFT: Linearity, Time shift, Frequency shift, Time scaling, Differentiation in time, Differentiation in frequency, Summation in time, Convolution in time domain, Multiplication in time domain, Parseval's theorem [1].

DFT representation of signals and Properties of DFT: DFT representation of signals, twiddle factor and its properties, Computation of DFT by matrix method, analytical method, Relation between DTFT and DFT, Properties of DFT: Linearity, Time reversal, Circular time shift, Circular frequency shift, complex conjugation, Circular convolution, Circular correlation, Multiplication of two sequences, Parseval's theorem. IDFT. Numerical based on properties of DFT [2].

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://nptel.ac.in/courses/117102060 (DSP, Prof. S.C. Dutta Roy, IIT Delhi). Lectures 8 to 11.
  https://nptel.ac.in/courses/108106151(DSP, C. S. Ramalingam, IIT Madras). Under Download link, lectures with title DFT (Last nine videos).
  https://nptel.ac.in/courses/108101174 (DSP, Prof. V. M. Gadre, IIT Bombay). Week-4 for DTFT.

Unit III

Fast Fourier transforms: Definition of FFT (introduction to FFT), comparison of computation complexity of DFT computation by direct method and FFT method, Radix-2 decimation in time FFT for 4 & 8 points derivation and applications. Radix-2 decimation in time FFT for 4 & 8 points derivation and applications. Computation of IDFT using Flow-graphs, N composite FFT, Six-point DIT FFT, six-point DIF FFT [2][6].

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://nptel.ac.in/courses/108104100 (Signals and classifications, Prof. Aditya K. Jagannatham, IIT Kanpur)
  https://nptel.ac.in/courses/117102060 (DSP, Prof. S.C. Dutta Roy, IIT Delhi)
  https://nptel.ac.in/courses/108106151(DSP, C. S. Ramalingam, IIT Madras)
  https://nptel.ac.in/courses/108101174 (DSP, Prof. V. M. Gadre, IIT Bombay)

Unit IV

Digital filters: Introduction to digital filters, advantages of digital filters, Infinite Impulse response (IIR) Filters: types of IIR filters (Butterworth and Chebyshev), IIR filter design by approximation of derivatives, Derivation of Impulse invariant transformation, IIR Butterworth filter design by impulse invariant method, Derivation of Bilinear transformation and its properties, IIR Butterworth filter design using Bilinear transformation. Introduction to frequency transformations, basic filter transformation examples [3].

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://nptel.ac.in/courses/117102060 (DSP, Prof. S.C. Dutta Roy, IIT Delhi). IIR filter design lecture 35.
  https://nptel.ac.in/courses/108101174 (DSP, Prof. V. M. Gadre, IIT Bombay). Week-7 for IIR filter design. Analog Frequency transformation in week-8, lecture 25A, Week-9 lecture 26A.

Unit V

FIR Filters: Introduction, advantages and disadvantages of FIR filters, Magnitude response and phase response of FIR digital filters, frequency response of linear phase FIR filters, Window functions for design of FIR filters, Design techniques for FIR filters- windowing method (only Hamming, Hanning, rectangular). [3]

Applications of DSP: DSP system, DTMF [5] standard, DTMF generation and detection, DSP based biotelemetry receiver, A speech processing system, an image processing system. DSP based power meter [4]

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://nptel.ac.in/courses/117102060 (DSP, Prof. S.C. Dutta Roy, IIT Delhi). FIR filter design lecture 38 to 40.
  https://nptel.ac.in/courses/108101174 (DSP, Prof. V. M. Gadre, IIT Bombay). FIR filters week10 lecture 29A to 31B.

*Numbers mentioned in square brackets are the serial number of text books to be used.

Text Books

1. Signals and Systems, Symon Haykin and Barry Van Veen, John Wiley and Sons.
2. Digital signal processing, Proakis and Manolakis, 3rdEdition Prentice Hall of India.
3. Introduction to Digital Signal Processing, Johny R johnson, PHI.
4. Digital signal processing, Avatar Singh and S. Srinivasan, Thomson.
5. Digital Signal Processing: A Computer Based Approach, Sanjit K. Mitra, McGraw-Hill.
6. Digital signal processing, S. Salivahanan, A. Vallavaraj, McGraw-Hill, 2009.

References:

1. Signals and Systems: Alan V. Oppenheim, Alan S. Willsky, and with S. Hamid, PHI
2. Digital signal Processing-Alan V. Oppenheim, Ronald W. Schafer, Prentice Hall of India.

Course Outcomes (COs):

After completion of the course, the students will be able to-

1. Identify the type of the signal and apply basic operations to them. (PO-1, PO-2, PO-3, PO-10, PSO-1, PSO-3)
2. Compute DTFT and DFT of the given signals, and will also be able to use the properties of DFT and DTFT. (PO-1, PO-2, PO-3, PO-10, PSO-1, PSO-3)
3. Compute DFT of a given signal using DIT-FFT and DIF-FFT algorithms. (PO-1, PO-2, PO-3, PO-10, PSO-1, PSO-3)
4. Design a digital Butterworth filter using IIT and BLT to meet the given specifications. (PO-1, PO-2, PO-3, PO-5, PO-10, PSO-1, PSO-2, PSO-3)
5. Design an FIR linear phase filter using windowing method to meet the given specifications, students will have an understanding of basic applications of DSP. (PO-1, PO-2, PO-3, PO-5, PO-10, PSO-1, PSO-2, PSO-3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal test shall be taken for 30 marks		
Other components		
Quiz	10	CO1 - CO5
Assignment	10	CO1 - CO5
Semester End Examination (SEE) (Scaled to 50 marks)	**100**	CO1 - CO5

DIGITAL SIGNAL PROCESSING LAB	
Course Code: EIL46	**Credits:** 0:0:1
Pre – requisites: Nil	**Contact Hours:** 14P
Course Coordinator: Dr. G. Shivaprakash	

The lab course is designed to imparting skills required to develop a DSP system. Exposure to the DSK TMS3206713 and Scilab are the main features of the course.

List of experiments

1. Familiarization with SCILAB
2. Familiarization with code composer studio (CCS)
3. Experiment to compute the linear convolution (C program). Verify results using SCILAB.
4. Experiment to compute the circular convolution (C program). Verify results using SCILAB.
5. Experiment to compute the correlation (C program). Verify results using SCILAB.
6. Signal generation with given specification and basic operations on signals using SCILAB.
7. Experiment to determine the linear convolution using FFT (FFT library function call).
8. Experiment to determine the spectrum of given sequence using FFT (FFT library function call).
9. Experiment to design and test Butterworth I and II order low pass filter (C and Scilab programs).
10. Real-time Sine wave generation using look up table method.
11. Experiment to generate and detect DTMF signal using SCILAB software only.
12. Experiment to design and test FIR filter using hamming windowing techniques (C and Scilab programs).
13. Experiment to design and test FIR filter using hanning windowing techniques (C and Scilab programs).
14. FD Tool of MATLAB filter design.

Text Books

1. Signals and Systems, Symon Haykin and Barry Van Veen, John Wiley and Sons.
2. Digital signal processing, Proakis and Manolakis, 3rdEdition Prentice Hall of India.

3. Introduction to Digital Signal Processing, Johny R johnson, PHI.
4. Digital signal processing, Avatar Singh and S. Srinivasan, Thomson.
5. Digital Signal Processing: A Computer Based Approach, Sanjit K. Mitra, McGraw-Hill.
6. Digital signal processing, S. Salivahanan, A. Vallavaraj, McGraw-Hill, 2009.

Course Outcomes (COs):

At the end of the course, students will be able to

1. Write programs (C/SCILAB) to compute convolution, correlation, FFT, and spectrum. (PO-1, PO-2, PO-4, PO-5, PO-9, PO-10, PSO-1, PSO-3)
2. Design and implement IIR and FIR digital filters to meet given performance specifications. (PO-1, PO-2, PO-3, PO-5, PO-9, PO-10, PSO-1, PSO-3)
3. Write programs (SCILAB) for signal generation/manipulation and real time DSP algorithms. (PO-1, PO-2, PO-5, PO-9, PO-10, PSO-1, PSO-3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Weekly evaluation of laboratory journals/ reports after the conduction of every experiment.	30	CO1, CO2, CO3
Practical test	20	CO1, CO2, CO3
Semester End Examination (SEE)	50	CO1, CO2, CO3

PROCESSOR ARCHITECTURE AND EMBEDDED CONTROLLERS LAB	
Course Code: EIL47	**Credits:** 0:0:1
Pre – requisites: Fundamentals of Computing (CS26)	**Contact Hours:** 14P
Course Coordinator: Dr. Elavaar Kuzhali S	

List of experiments

Part A: Assembly language programs

1. (i) Swap two numbers without using an intermediate register
   (ii) To find the factorial of a given number
   (iii) Convert word of little endian format to big endian format.
2. Generate 12 bit Hamming code from a given 8 bit code
3. (i) Move a string from given memory location to another location
   (ii)To Add N numbers of data stored consecutively in memory location
   (iii) Translate the given C code to assembly, for r (i=0;i<8;i++){a[i] = b[7 – i];}
4. (i) Move a block of data from memory location to another location using LOAD multiple and STORE multiple instructions
   ii) Exchange a block of data between memory locations
5. i) Arrange a given set of data in ascending order
   ii) Arrange a given set of data in descending order
6. i) Implement subroutine nesting using stack
   ii) To implement ARM –THUMB interworking to find the smallest.
   iii) To handle swi instruction in the program

Part B: C Programs

1. To familiarize I/O ports of LPC 2148 - on/off control of LEDs using switches
2. To display a given string using the LCD display interface
3. Interface key pad and to display the key pressed on LCD
4. Waveform generation using the internal DAC of LPC 2148.
5. To convert a given analog voltage to digital using ADC of LPC 2148.
6. Using timers to generate a specified delay
7. Using timer/counter/capture module of LPC 2148 to count the number of pulses and display on LCD.
8. Use of UART of LPC 2148 for transmitting and receiving data

Reference Books:

1. Laboratory manual prepared by the Electronics & Instrumentation Engineering department, RIT, Bangalore
2. https://www.nxp.com/docs/en/user-guide/UM10139.pdf

Web links for video lectures (e-Resources):

1. http://103.170.244.45/~instrumentation/4th%20Semester/EI43/
2. http://103.170.244.45/~instrumentation/6th%20Semester/EI61(O)-Advanced%20Embedded%20Controllers/

Course Outcomes (COs):

At the end of the course, students will be able to

1. Write ARM/THUMB assembly level programs using Keil software. (PO-1, PO-2, PO-3, PO-5, PO-9, PO-10, PSO-1, PSO-3)
2. Write embedded C programs to interact with Built-in-Peripherals (GPIO's, DAC, ADC, Timer/Counter, and UART) of ARM7 LPC 2418. (PO-1, PO-2, PO-3, PO-5, PO-9, PO-10, PSO-1, PSO-3)
3. Write programs to handle exceptions and interrupts in ARM processor. (PO-1, PO-2, PO-3, PO-5, PO-9, PO-10, PSO-1, PSO-3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Weekly evaluation of laboratory journals/ reports after the conduction of every experiment.	30	CO1, CO2, CO3
Practical test	20	CO1, CO2, CO3
Semester End Examination (SEE)	50	CO1, CO2, CO3

PROCESS INSTRUMENTATION LAB	
Course Code: EIL48	**Credits:** 0:0:1
Pre – requisites: Measurement and Instrumentation (EI35)	**Contact Hours:** 14P
Course Coordinator: Dr. M D Nandeesh	

List of Experiments:

1. Experiment to measure Flow using Orifice.
2. Experiment to measure Flow using Venturi tube.
3. Experiment to verify Bernoulli's theorem.
4. Experiment to study different types of flow and determine the Reynold's Number.
5. Experiment to measure viscosity using Saybolt viscometer.
6. Experiment to measure relative Humidity by capacitive sensor.
7. Experiment to measure moisture content in given sample of soil.
8. Experiment to measure PH of solutions using PH electrode.
9. Experiment to measure conductivity of solutions.
10. Experiment to measure Level using differential pressure transmitter.
11. Experiment to study characteristics of different valves.
12. Experiment to study characteristics of electrical valve.
13. Experiment to measure flow using rotameter.
14. Experiment to measure relative humidity using dry and wet bulb psychrometer

Text Book:

1. Measurement systems application and design, E.O.Doebline 4th edition,TMH
2. Instrumentation for Process Measurement Norman. A. Anderson,3rd edition, CRC
3. Principle of Measurement System by John. P. Bentley, 3rd edition, Pearson,2007
4. Process Measurement by Bela .G. Liptak

Course Outcome (COs):

At the end of the course, students will be able to

1. Understand the measurement of flow, viscosity, humidity, moisture, PH, conductivity and level. (PO-1,2,3,9,10, PSO-1,3)
2. Analyse the performance characteristics of various valves. (PO-1,2,3,9,10, PSO-1,3)
3. Theoretically verify few basic theorems. (PO-1,2,3,9,10, PSO-1,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Weekly evaluation of laboratory records/ reports after the conduction of every experiment. Follow up and Viva	20 10	CO1,CO2,CO3
Practical test	20	CO1,CO2,CO3
Semester End Examination (SEE)	**50**	CO1,CO2,CO3

BIOLOGY FOR ENGINEERS	
Course Code: EIAEC49	**Credits:** 1:0:0
Pre – requisites: Nil	**Contact Hours:** 14L
Course Coordinator: Dr. Christina Grace	

Course content:

Unit 1: Skin and Blood

Skin: Layers of skin, accessory structures, functions of integumentary system, Diseases and disorders

Blood: Overview of blood and its components, Hemostasis, Blood typing, Disorders

- **Pedagogy / Course delivery tools**: Chalk and talk, Presentation, Videos, Self-study component

Unit 2: Digestive and Respiratory system

Digestive system: Overview, Digestive system processes and regulations, Different organs, Chemical digestion and absorption, Disorders

Respiratory system: Organs and structures of respiratory system, lungs, gas exchange and transport, modifications in respiratory functions, Disorders

- **Pedagogy / Course delivery tools**: Chalk and talk, Presentation, Videos, Self-study component

Unit 3: Cardiovascular system

Heart anatomy, cardiac muscle and electrical activity, cardiac cycle, physiology, structure and function of blood vessels

Blood flow, pressure and resistance, capillary exchange, Homeostatic Regulation of the Vascular System, Circulatory pathways, Disorders

- **Pedagogy / Course delivery tools**: Chalk and talk, Presentation, Videos, Self-study component

Unit 4: Nervous system

Basic Structure and Function of the Nervous System, Nervous tissue and its function, Action potential, communication between neurons,

Central and peripheral nervous system, sensory perception, central processing, motor responses, disorders

- **Pedagogy / Course delivery tools**: Chalk and talk, Presentation, Videos, Self-study component

Unit 5: Muscular and Skeletal system

Overview and types of muscle tissues, Muscle Fibre Contraction and Relaxation, Nervous System Control of Muscle Tension, Exercise and muscle performance,

Disorders
The Functions of the Skeletal System, Bone classification, structure and divisions, Exercise, Nutrition, Hormones and Bone Tissue, Calcium Homeostasis, Disorders

- **Pedagogy / Course delivery tools**: Chalk and talk, Presentation, Videos, Self-study component

Text book/s:

1. Langford, Kevin - The Everything Guide to Anatomy and Physiology_ All You Need to Know about How the Human Body Works-F W Media_Everything_Adams Media (2015)
2. Anna Chruścik, Kate Kauter, Louisa Windus, And Eliza Whiteside; Leanne Dooley, 'Fundamentals of Anatomy and Physiology', University of Southern Queensland

Reference book/s:

1. Gerard J Tortora, Bryan Derrickson, 'Introduction to the human body _ the essentials of anatomy and physiology', John Wiley & Sons, 2010

Web links:

1. https://human.biodigital.com/explore
2. https://www.digitalteacher.in/human-anatomy

Course Outcomes:

At the end of the course, the student will be able to:

1. Describe the overview of various organ systems in the human body (PO2, PO6, PO12, PSO1).
2. Illustrate various organ systems (PO2, PO6, PO12, PSO1).
3. Explain the origin and aspects of various electric signals from the human body (PO2, PO6, PO12, PSO1).
4. Describe various diseases or disorders of the organ systems (PO2, PO6, PO12, PSO1).
5. Examine the function of a specific organ/ tissue in the organ system (PO2, PO6, PO12, PSO1).

Course Assessment and Evaluation:

Continuous Internal Evaluation: 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3-CO5

Average of the two internal test shall be taken for 30 marks		
Other components		
Report submission	10	CO1 - CO5
Assignment	10	CO1 - CO5
Semester End Examination:	**50**	CO1 - CO5

ADDITIONAL MATHEMATICS - II	
Course Code: AM41	**Credits:** 0:0:0
Pre – requisites: Nil	**Contact Hours:** 42L
Course Coordinator: Dr. Veena B N	

Unit I

Differential Calculus- I: Partial differentiation, Euler's theorem, total differential coefficient, differentiation of composite and implicit functions.

- Pedagogy/Course delivery tools: Chalk and talk
- Online tools: Use of open source software's to demonstrate methods and solve problems on interpolation
- Links: https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: https://a.impartus.com/ilc/#/course/107625/1030

Unit II

Differential Calculus- II: Jacobian and Properties. Taylor's theorem for function of two variables, maxima and minima for functions of two variables.

- Pedagogy/Course delivery tools: Chalk and talk
- Online tools: Use of open source software's to demonstrate methods and solve problems on numerical differentiation and integration.
- Links: https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: https://a.impartus.com/ilc/#/course/107625/1030 https://a.impartus.com/ilc/#/course/59742/295

Unit III

Vector Integration: Line integrals, surface integrals and volume integrals. Green's theorem, Stokes' and Gauss divergence theorem (without proof) and problems, orthogonal curvilinear coordinates.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://nptel.ac.in/courses/111/105/111105134/
- Impartus recording: https://a.impartus.com/ilc/#/course/619570/1030

Unit IV

Higher Order Differential Equations: Higher order linear differential equations, method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: https://a.impartus.com/ilc/#/course/96127/452
  https://a.impartus.com/ilc/#/course/59742/295

Unit V

Probability: Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability- illustrative examples. Bayes theorem – examples.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://nptel.ac.in/courses/111/107/111107119/
  https://nptel.ac.in/courses/111/107/111107119/
- Impartus recording: https://a.impartus.com/ilc/#/course/283623/703

Text Books:

1. **B.S. Grewal** – Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
2. **Erwin Kreyszig** – Advanced Engineering Mathematics – Wiley Publication, 10th Edition, 2015.

Reference Books:

1. **H. K. Dass** – Higher Engineering Mathematics – S Chand Publications, 1998
2. **B. V. Ramana** – Engineering Mathematics – Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2008.

Course Outcomes (COs):

At the end of the course the student will be able to

1. To carryout differentiation of function of several variables.
2. Solve the problems related to Jacobians, the extreme values of a function and Taylors series.
3. Exhibit the interdependence of line, surface and volume integrals using integral theorems.
4. Find the solution of second and higher order ODEs with constant and variable coefficients.
5. Solve the problems on conditional probability and Baye's theorem.