RAMAIAH
Institute of Technology

CURRICULUM

Academic year 2023 - 2024

ELECTRICAL AND ELECTRONICS ENGINEERING

III & IV SEMESTER B.E.

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
Bangalore – 560054.

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 has 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 67% 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. **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. The Institute is a member of DELNET, CMTI and VTU E-Library Consortium. The Institute has a modern auditorium, recording studio, 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, Ramaiah Institute of Technology has achieved 78th rank among 1314 top Engineering Institutions & 23rd Rank for School of Architecture in India for the year 2023.

About the Department

The department was started in the year 1962 along with the establishment of the Institute. In 2003, the Department has been recognized as a Research Centre by Visvesvaraya Technological University, Belagavi and offers Ph.D and MS(by Research) programs. UG programme has been accredited by NBA since 2001. The department has 17 well-qualified faculty members. The entire faculty holds postgraduate degree specialized in diversified areas of Electrical Engineering like Power Systems, Power Electronics, Control Systems, Electrical Machines, etc. 13 of the faculty members are doctorates from various esteemed institutions like IISc, Bangalore, IIT-Dhanbad, NITK, Surathkal, Vellore Institute of Technology, Vellore, Visvesvaraya Technological University, Belagavi, Pondicherry University, Pondicherry and Jain University, Bengaluru. In addition, the department is actively involved in research, testing and consultancy in the area of high voltage applications under the able guidance of Dr. G. R. Nagabhushana, Formerly Chairman, Dept. of High Voltage Engineering, Indian Institute of Science, Bangalore, and is presently with the department as Professor Emeritus. The main focus of the department is to impart quality technical education to students in UG, PG and Ph.D levels based on OBE. Many technical activities are in place to enhance both technical and communication skills for students and staff.

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

MSRIT shall meet the global socio-economic needs through

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

QUALITY POLICY

We at M S 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 excel in engineering education and research, inculcating professional ethics in students and emerge as leaders globally in the field of electrical & electronics engineering.

MISSION OF THE DEPARTMENT

The mission of the department is to produce graduates who will

1. Be able to apply their knowledge to identify and solve problems arising in any industry.
2. Be able to contribute to research and developmental activities in frontier areas.
3. Master innovative skills to be entrepreneurs and/or consultants engineers

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO1: Produce graduates who will have the ability to apply the knowledge of basic Sciences engineering sciences and electrical engineering to excel in professional career

PEO2: Produce graduates who will continue to enhance their knowledge.

PEO3: Produce graduates who are confident to take up diverse career paths.

PEO4: Produce graduates who will provide leadership and demonstrate the importance of professional integrity.

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 of the 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: Identify, formulate, analyze, design and implement—electrical and electronics circuits, control systems, drives, power systems and power electronic systems.

PSO2: Use modern tools to solve problems in diverse and multidisciplinary environment.

PSO3: Understand the impact of engineering solutions in societal and environmental context, commit to professional ethics, lifelong learning and communicate effectively

PSO4: Apply project management techniques to electrical/electronic(s) systems, exhibiting team work.

Semester wise Credit Breakdown for B.E Degree Curriculum
Batch 2022-26

Semester / Course Category	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Total Credits
Basic Sciences (BSC)	08	08	03	03	--	--	--	--	22
Engineering Sciences (ESC)	08	09	--	--	--	--	--	--	17
Humanities, Social Sciences and Management (HSMC)	02	02	--	--	03	03	--	--	10
Ability Enhancement Course (AEC)	02	01	01	01	01	--	03	--	09
Universal Human Values (UHV)	--	--	02	--	--	--	--	--	02
Professional Core Courses (PCC)	--	--	11	12	12	06	04	--	45
Integrated Professional Core Course (IPCC)	--	--	04	04	03	--	04	--	15
Professional Elective Courses (PEC)	--	--	--	--	03	06	03	--	12
Institutional Open Elective Courses (IOE)	--	--	--	--	--	03	03	--	06
Internship (INT)	--	--	--	Yes	--	--	--	05	05
Mini Project / Project Work (PW)	--	--	--	--	--	04	03	10	17
Non Credit Mandatory Courses (NCMC)	--	--	Yes	--	Yes	--	--	Yes	--
Total Credits	20	20	21	20	22	22	20	15	160

SCHEME OF TEACHING III SEMESTER

Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week
					L	T	P	Total	
1	EE31	Transform Techniques and Linear Programming	Maths	BSC	2	1	0	3	4
2	EE32	Introduction to Python Programming for Electrical Applications	EEE	IPCC	3	0	1	4	5
3	EE33	Electronic Devices and Circuits	EEE	PCC	3	0	0	3	3
4	EE34	Digital Electronics	EEE	PCC	3	0	0	3	3
5	EE35	Electrical AC Machines	EEE	PCC	3	0	0	3	3
6	EEL36	Digital Electronics Lab	EEE	PCC	0	0	1	1	2
7	EEL37	Electronic Devices and Circuits Lab	EEE	PCC	0	0	1	1	2
8	UHV38	Universal Human Values	EEE	UHV	2	0	0	2	2
9	EEAEC39	Ability Enhancement Course - III	EEE	AEC	1	0	0	1	1
				Total	17	1	3	**21**	**24**
10	PE83	Physical Education		NCMC	All students have to register compulsorily for any one of the courses with the concerned coordinator (Yoga Teacher/ Physical Education Director/ NSS Coordinator) in the beginning of the III semester. Attending the registered course from III to VIII semesters. Qualifying is mandatory for the award of the degree.				
	YO83	Yoga							
	NS83	NSS							
11	AM31	Additional Mathematics - I *****		NCMC	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 04 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, Inter/Intra Institutional Internship: All the students admitted under the lateral entry category shall have to undergo a mandatory summer Internship of 02 weeks which is an NCMC course, during the intervening

vacation of the III and IV semesters. Summer Internship shall include Inter / Intra Institutional activities. A Viva-voce examination shall be conducted during the IV semester. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of the 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:**

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 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. 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.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week
					L	T	P	Total	
1	EE41	Numerical Methods and Probability Models	Maths	BSC	2	1	0	3	4
2	EE42	Electrical Measurements and Instrumentation	EEE	IPCC	3	0	1	4	5
3	EE43	Field Theory	EEE	PCC	3	0	0	3	3
4	EE44	Microcontroller Programming & Interfacing	EEE	PCC	3	0	0	3	3
5	EE45	Electric Networks	EEE	PCC	2	1	0	3	3
6	EEL46	Microcontrollers & Applications Lab	EEE	PCC	0	0	1	1	2
7	EEL47	Electrical AC Machines Lab	EEE	PCC	0	0	1	1	2
8	EEL48	Introduction to Product Design Lab	EEE	PCC	0	0	1	1	2
9	EEAEC49	Ability Enhancement Course - IV	EEE	AEC	1	0	0	1	1
10	INT410	Inter/ Intra Institutional Internship	EEE	NCMC	0	0	0	0	-
				Total	**14**	**2**	**4**	**20**	**25**
11	AM41	Additional Mathematics II *****	Maths	NCMC	0	0	0	0	-

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 04 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.

*** 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 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 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. 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.

III SEMESTER

TRANSFORM TECHNIQUES AND LINEAR PROGRAMMING	
Course Code: EE31	**Credits: 2:1:0**
Pre – requisites: Nil	**Contact Hours: 28L+14T**
Course Coordinator: Dr. Monica Anand & Dr. Uma M	

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.

Reference Books:

1. Glyn James – Advanced Modern Engineering Mathematics – Pearson Education – 4th edition – 2010.
2. Dennis G. Zill, Michael R. Cullen - Advanced Engineering Mathematics, Jones and Barlett Publishers Inc. – 3rdedition – 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-2)
2. Solve initial and boundary value problems using Laplace transforms. (PO-1, PO-2, PSO-1, PSO-2)
3. Construct the Fourier series expansion of a function/tabulated data. (PO-1, PO-2 PSO-1, PSO-2)
4. Evaluate Fourier transforms of functions and use it to solve ODE's. (PO-1, PO-2, PSO-1, PSO-2)
5. Formulate and solve a simple linear programming problem. (PO-1, PO-2, PSO-1, PSO-2)

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)	100	CO1, CO2, CO3, CO4, CO5

INTRODUCTION TO PYTHON PROGRAMMING FOR ELECTRICAL APPLICATIONS	
Course Code: EE32	**Credits: 3:0:1**
Pre – requisites: Nil	**Contact Hours: 28L+14P**
Course Coordinator: Dr. Hemachandra Gudimindla	

Course Content

Unit I

Introduction and Programming Fundamentals

Necessity and definition of programming language. Keywords, Variables, Expressions and statements, Data types, Operators, Implicit/Explicit Type conversions.

Control Structures

if, else, elif, nested if statements, Iteration Control structures (for, while), break, continue, pass.

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Links to online lectures: https://youtu.be/41qgdwd3zAg
  https://www.youtube.com/watch?v=Lbs7vmx3YwU&index=2&list=PLS1QulWo1RIaJECMeUT4LFwJ-ghgoSH6n
  https://www.youtube.com/watch?v=GTpl5yq3bvk&list=PLS1QulWo1RIaJECMeUT4LFwJ-ghgoSH6n&index=4
  https://www.youtube.com/watch?v=dw3jaIj1ylw&index=5&list=PLS1QulWo1RIaJECMeUT4LFwJ-ghgoSH6n

Unit II

Collections

Strings, Tuples, Lists, Sets & Dictionary

Functions Defining & calling a function, passing arguments, Mutable & Immutable data types, Types of argument, scope of a variable, Recursive functions

Exception Handling try, except, try...finally, Handling exception in code

- Pedagogy/Course delivery tools: Chalk and Talk
- Links to online lectures:
  https://www.youtube.com/watch?v=YuVcBm_J2js&index=11&list=PLS1QulWo1RIaJECMeUT4LFwJ-ghgoSH6n
  https://www.youtube.com/watch?v=Uh2ebFW8OYM
  https://www.youtube.com/watch?v=xBDGux27Qrg&index=6&list=PLS1QulWo1RIaJECMeUT4LFwJ-ghgoSH6n
  https://www.youtube.com/watch?v=-nJvt_7lsk&list=PLS1QulWo1RIaJECMeUT4LFwJ-ghgoSH6n&index=9

Unit III

Modules and Packages, Libraries and Functions

Modules and Packages, Random Library, Math library String functions, List functions, Dictionary functions Date and Time functions.

File Handling Open, Read, Write, append, with, split.

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Links to online lectures: https://www.youtube.com/watch?v=dV9K6QMrIn4&index=7&list=PLS1QulWo1RIaJECMeUT4LFwJ-ghgoSH6n
- https://www.youtube.com/watch?v=GTpl5yq3bvk&list=PLS1QulWo1RIaJECMeUT4LFwJ-ghgoSH6n&index=4
- https://www.youtube.com/watch?v=fDoYwL90WUg&list=PLS1QulWo1RIaJECMeUT4LFwJ-ghgoSH6n&index=8

Unit IV

Object Oriented Programming

Creating classes, Instance variables & access specifiers, methods and complete python program, importance of self, __init__() method, instance method, class method and static method, using default parameters in methods

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Links to online lectures: https://www.youtube.com/watch?v=ZDa-Z5JzLYM&list=PL-osiE80TeTsqhIuOqKhwlXsIBIdSeYtc
  https://www.youtube.com/watch?v=RSl87lqOXDE&list=PL-osiE80TeTsqhIuOqKhwlXsIBIdSeYtc&index=4
  https://www.youtube.com/watch?v=jCzT9XFZ5bw&index=6&list=PL-osiE80TeTsqhIuOqKhwlXsIBIdSeYtc
  https://youtu.be/xOuRE3IuEB8

Unit V

Introduction to Data Structures

Introduction to List, List using Array - Operations, List using Linked List - Introduction, List using Linked List – Operations**,** Introduction to Stack and Queue, Stack – Operations**,** Queue - Operations

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Links to online lectures: https://youtu.be/WGJJIrtnfpk
  https://www.youtube.com/watch?v=0r8iIb32WC8
  https://www.youtube.com/watch?v=6cwi1NcL0Zc
  https://www.youtube.com/watch?v=XiVVYfgDolU
  https://youtu.be/m9n2f9lhtrw

List of Programs:

1. Write a python code to determine the power consumption of the lamps, when the lamps are connected in series and also identify which bulb will glow brighter.
2. Write a python code to verify voltage division rule, current division rule and star-delta transformation.
3. Write a python code to verify KCL and KVL for a simple circuit.
4. Write a python code to determine the maximum safe voltage can be applied across the capacitor circuit configurations.
5. Write a python code to determine the choke coil resistance and inductance using a known series connected resistor.
6. Write a python code to find the branch current and node voltage for a simple DC circuit.
7. Write a Python code to analyse the transient response of series RL/RC/RLC circuit with DC excitation.
8. Write a python code to plot the voltage, current and power waveforms for the given RL/RC/RLC circuit with AC excitation.
9. Write a python code to print the electricity bill management system.
10. Write a python code to plot the speed-torque and power- speed characteristics for DC motor.

Text Books:

1. Charles R Severence, "Python for Everybody: Exploring Data Using Python 3", 1st edition, CreateSpace Independent Publishing platform, 2016.
2. Allen B. Downey, "How to think like a computer scientist", 2nd edition, Green Tea press, 2015.
3. Roberto Tamassia, Michael H Goldwasser, Michael T Goodrich, "Data Structures and Algorithms in Python",1 st Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126562176
4. Kenneth A. Lambert, "Fundamentals of Python Data Structures"-Cengage Learning (2018)

Reference Books:

1. Charles Dierbach, "Introduction to computer science using Python", 1st edition, Wiley India Pvt Ltd.
2. Mark Lutz, "Programming Python", 4th edition, O'Reilly Media
3. Wesley J Chun, "Core Python Application Programming", 3rd Edition, Pearson Education, India, 2015 Reference: https://docs.python.org

Course Outcomes (COs):

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

1. Examine Python syntax and semantics and be fluent in the use of Python flow control structures and functions. (PO-1, PO-2, PO-3, PO-5, PSO-2, PSO-4)
2. Code, test and debug and manipulate Simple Python programs (PO-1, PO-2, PO-3, PO-5, PSO-2, PSO-4)
3. Handle exceptions and work with files. (PO-1, PO-2, PO-3, PO-5, PSO-2, PSO-4)
4. Create solutions using object-oriented paradigm and data structures. (PO-1, PO-2, PO-3, PO-5, PSO-2, PSO-4)

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
Average of the two internal test will be taken for 30 marks		
Other components		
Assignment / Lab Evalution	10	CO4
Quiz / Lab Test / Practical Test	10	CO3, CO4
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4

ELECTRONIC DEVICES AND CIRCUITS	
Course Code: EE33	**Credits: 3:0:0**
Pre – requisites: Nil	**Contact Hours: 42L**
Course Coordinator: Sri. Ramkrishna Murthy, Dr. Sridhar. S	

Course Content

Unit I

Metal Oxide Semiconductor FET: Introduction, Construction and basic operation, Structure, Regions of operation: Cut-off, Linear, and Saturation regions, types of MOSFETs, control of threshold voltage – external biasing, MOSFET biasing – Enhanced and depletion type, V-I Characteristics

Introduction to Operational Amplifier: Op-Amp description – Circuit symbol and terminals, current, impedance and voltage level, equivalent circuit and block diagram of an Op-Amp. Basic op-amp parameters: Input and output voltage range, offset voltage and current, offset nulling, CMRR, PSRR, input and output impedance, slew rate and frequency limitation.

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for MOSFET characteristics: https://a.impartus.com/ilc/#/video/id/3777293
- Link for Introduction to Op-Amp: https://a.impartus.com/ilc/#/video/id/3417178

Unit II

Op-Amp as D.C. Amplifier: Biasing operational amplifier, D.C. coupled voltage follower, D.C. coupled non inverting amplifier, D.C. coupled inverting amplifier, summing amplifiers and differential amplifier.

Op-Amp with Negative feedback: Introduction, block diagram representation of feedback configuration, voltage series feedback amplifier, voltage shunt feedback amplifier.

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for Op-amp Amplifiers: https://a.impartus.com/ilc/#/video/id/3466342
- Link for Op-Amp with Negative feedback: https://a.impartus.com/ilc/#/video/id/3646436

Unit III

Signal Processing Circuits: Introduction, precision half wave rectifier: saturating precision rectifier, non-saturating precision rectifier, two output precision rectifier,

precision full wave rectifiers: half wave rectifier and summing circuit, high input impedance full wave precision rectifier, Peak clipper, dead zone circuit, precision clipper, precision clamping circuit, precision rectifier peak detector, voltage follower peak detector, sample and hold circuit.

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for Precision Rectifiers: https://a.impartus.com/ilc/#/video/id/3510734
- Link for Precision Clippers: https://a.impartus.com/ilc/#/video/id/3542370

Unit IV

Active Filters: Introduction, first order low and high pass Butterworth filter, second order low and high pass Butterworth filter, band pass filter and band reject filter.

Comparators: Positive feedback, upper threshold voltage, lower threshold voltage, zero crossing detector with hysteresis, inverting voltage level detectors with hysteresis, non-inverting voltage level detectors with hysteresis, voltage level detector with independent adjustment of hysteresis and center voltage.

Integrator and differentiator

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for Active Filters: https://a.impartus.com/ilc/#/video/id/3552070
- Link for Comparators: https://a.impartus.com/ilc/#/video/id/3542370

Unit V

Signal Generators: Basic principle of oscillator, phase shift oscillator, Wein bridge oscillator, Square wave generator, triangular wave generator and saw tooth wave generator. (Oscillator using Op-Amps only. Circuit, explanation and design only. Analysis excluded)

Specialized IC Applications: 555 timer, 555 timer as a monostable multivibrator, monostable multivibrator applications, 555 timer as an astable multivibrator, astable multivibrator applications, voltage regulators: fixed voltage regulators, adjustable voltage regulators.

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for Astable multivibrator:
- https://www.youtube.com/watch?v=iJYm_BGqa1A
- Link for Monostable Multivibrator:
  https://www.youtube.com/watch?v=ypV6gdIJJU4

Text Books:

1. Kanaan Kano *"Semiconductor Devices"*, Pearson Education, 2006 (for Topic Metal Oxide Semiconductor FET)
2. David A Bell, "*Operational amplifiers and Linear IC's*", Prentice Hall, 2nd Edition. (For the following topics: Introduction to Operational amplifier, OP-AMP as D.C. Amplifier, Signal Processing circuits)
3. Ramakant A Gayakwad, "*Op-Amps and Linear Integrated Circuits*", Prentice Hall, 4th Edition. (For the topics: Active Filters, Signal Generators, Op-Amp with negative feedback, Integrators and differentiators, Specialized IC Applications)
4. Robert F Couglin, Frederick F Driscoll, "*Operational Amplifiers and Linear Integrated Circuits*", Prentice Hall, 6th Edition. (For the topic: Comparators)

Reference Books:

1. Sergio Franco, "*Design with Operational Amplifiers and Analog Integrated Circuits*", TMC, 2008.
2. Roy Choudhary, "*Linear Integrated Circuits*", New Age International, 2003.
3. J. Nagarath, "*Electronic Devices & Circuits*", PHI, 2007.
4. Sudhaker Samuel, "*Electronic Circuits*", 2nd Edition, Tata McGraw Hill, 2010.

Web links for video lectures (e-Resources):

1. https://nptel.ac.in/courses/108108111
2. https://a.impartus.com/ilc/#/course/1253714/1112

Course Outcomes (COs):

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

1. Analyze VI characteristics of MOSFET and designing biasing circuit for MOSFET (PO 1,3, 4) (PSO 1)
2. Analyse various electrical characteristics of different IC's through interpretation of their data sheets. (PO 1, 3, 4) (PSO 1)
3. Design linear & non linear circuits for different functionality using Op-Amp (PO 1, 2, 3) (PSO 1)
4. Analyse linear & non linear circuits for different functionality using Op-Amp (PO 1, 2, 3) (PSO 1).
5. Illustrate the function of application specific ICs such as 555 timer and Voltage regulators (PO 1, 2, 3) (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
Average of the two internal test will be taken for 30 marks		
Other components		
Assignment	10	CO4, CO5
Quiz	10	CO2, CO3
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

DIGITAL ELECTRONICS	
Course Code: EE34	**Credits: 3:0:0**
Pre – requisites: Nil	**Contact Hours: 42L**
Course Coordinator: Dr. S Dawnee	

Course Content

Unit I

Principles of Combinational Logic

Review of Boolean algebra and basic gates, Definition of combinational logic, Canonical forms, Generation of switching equations from truth table, Karnaugh maps - 3, 4 variables, Map entered variables, Incompletely specified functions, Simplifying max term equations.

- Pedagogy / Course delivery tools: Chalk and Talk
- NPTEL Link: https://nptel.ac.in/courses/117106086 (Lectures 1-8)

Unit II

Analysis and Design of Combinational Logic I

General approach, Decoders- NAND gate implementation, types, using decoders as Boolean function generators, BCD decoders, encoders.

Analysis and Design of Combinational Logic II: Digital multiplexers-using multiplexers as Boolean function generators, adders & subtractors, Binary Comparators.

- Pedagogy / Course delivery tools: Chalk and Talk
- NPTEL Link: https://nptel.ac.in/courses/117106086 (Lectures 9-14)

Unit III

Sequential Circuits I

Basic bistable elements, SR latch, applications, Gated SR latch, D, T, JK flip flops, Characteristics equations, Master/Slave JK flip-flop, Edge triggered flip flop, conversion of one flip flop to another.

- Pedagogy / Course delivery tools: Chalk and Talk
- NPTEL Link: https://nptel.ac.in/courses/117106086 (Lectures 15-18)

Unit IV

Sequential Circuits II

Register, Counters, Asynchronous (ripple counters), Synchronous binary counters, Design of synchronous counters using different flip flops, Shift registers, Counters using shift registers.

- Pedagogy / Course delivery tools: Chalk and Talk
- NPTEL Link: https://nptel.ac.in/courses/117106086 (Lectures 16-19)

Unit V

Sequential Design

Introduction, Mealy and Moore Models, State Machine Notation, State diagram, Synchronous Sequential Circuit Analysis

- Pedagogy / Course delivery tools: Chalk and Talk
- Youtube Link: https://www.youtube.com/watch?v=YgtJlUXdCjI

Text Books:

1. Thomas L Floyd, Digital Fundamentals, TMH, 8th edition.
2. John M. Yarbrough, Digital Logic Applications & Design, Thomas Learning, 2001.

Reference Books:

1. Morris M.Mano, DigitalLogic & Computer Design, Prentice Hall, 2006.
2. Donald P Leach, Albert Paul Malvino, Digital Principles & Applications, Tata McGraw Hill, 4th Edition.
3. Donald D Givone, Digital Principles & Design, TMH, 2002.

Web links for video lectures(e-Resources):

1. https://nptel.ac.in/courses/117106086

Course Outcomes (COs):

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

1. Analyze the given design specification and formulate the solution in the form of Boolean equations (PO-1, PSO-1)
2. Develop combinational logic circuits using logic gates, multiplexers, decoders and other ICs (PO-1, PSO-1)
3. Learn functioning, design aspects and develop sequential circuits using different flip flops (PO-1, PSO-1)
4. Comprehend design aspects and develop counters using flip flops and shift registers (PO-1, PSO-1)
5. Design and develop finite state machines (PO-1, PSO-1**)**

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO1, CO2, CO3
Internal Test-II	30	CO3, CO4, CO5
Average of the two internal test will be taken for 30 marks		
Other components		
Quiz 1	10	CO1, CO2, CO3
Quiz 2	10	CO1, CO2, CO3
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

ELECTRICAL AC MACHINES	
Course Code: EE35	**Credits: 3:0:0**
Pre – requisites: Nil	**Contact Hours: 42L**
Course Coordinator: Dr. Nagaraj. C	

Course Content

Unit I

Single Phase Transformers and Induction Motors

Review of basics (Excluded from CIE and SEE)**,** Auto transformer, Tap changing transformers, Transformers on no-load and on load, Vector diagrams.

Analysis & performance, - Equivalent circuit, Losses, Power and all-day efficiency, Regulation, Parallel operation and load sharing

Testing of transformers: Polarity test SC, OC test, Sumpner's test

Single phase Induction Motors:

Working principle and Types of Single Phase Induction motors.

- Pedagogy / Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for Single Phase Transformer: https://www.youtube.com/playlist?list=PL59861DBF8EC85491

Unit II

Three phase transformer

Types of 3 phase transformers, Connections including open delta choice of connection, Phase Conversion-Scott connection, Parallel operation of three-phase transformers, Labeling of three phase transformers terminals and applications.

- Pedagogy / Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for Three Phase Transformer: https://www.youtube.com/watch?v=6oV9V05SA0I

Unit III

Three Phase Induction motors

Review of basics (Excluded from CIE and SEE)**,** Induction motor on no load & load, Efficiency and losses, Vector diagram, Equivalent circuit, Performance (hp, torque, efficiency, Current and power factor evaluation, Slip torque characteristics covering regions of motoring, generating and braking of induction generator.

Circle diagram: No load and blocked rotor tests, Circle diagram and Performance evaluation. Cogging and crawling, equivalent circuit and performance of double cage and deep bar rotor motor

Starting & Control:

Need for starter, DOL, star-delta, Auto transformer starting, Rotor resistance starting, Electronics starter (any one type), Speed control-voltage, Frequency and rotor resistance variations

- Pedagogy / Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for Three Phase Induction motor: https://youtube.com/playlist?list=PLbRMhDVUMngcDrGXlt-hX-ekpldUlC2b6

Unit IV

Three Phase Synchronous Generators

Review of basics (Excluded from CIE and SEE)**,** Regulation by EMF, MMF and ZPF, two reaction theory, slip test, Parallel operation of Alternators, synchronizing to infinite bus bars, Synchronizing power of Salient and non-salient pole Alternators, Power angle characteristics, Operation at constant load with variable excitation and vice versa.

- Pedagogy / Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for Three Phase Synchronous generator: https://youtube.com/playlist?list=PLPpCFgQP7QKHog5-n3DFqSxLI_LP-BvXP

Unit V

Synchronous Motor

Working Principle, hunting in synchronous machines, Damper windings, starting methods of a synchronous machine to run as a motor, Synchronous condenser, V and Inverted V curves. Permanent magnet synchronous motor. Line start PMSM

- Pedagogy / Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for Synchronous motor: https://youtube.com/playlist?list=PLPpCFgQP7QKHSJQnSwaigL89gshecycXs

Text Books:

1. J. Nagarath& Kothari, *Electric Machines*, TMH, 2nd Edition.

Reference Books:

1. Alexander Langsdorf, Theory *of Alternating Current Machines*, TMH, 2nd Edition
2. Ashfaq Hussain, *Electric Machines*, Dhanpat Rai & Co., 1999.
3. K. Theraja, BL Theraja *A Textbook of Electrical Technology - Volume II*, S Chand, 2005

Web links for video lectures (e-Resources):

1. https://a.impartus.com/ilc/#/course/96316/452
2. https://www.youtube.com/playlist?list=PLPpCFgQP7QKEA0Mi9WKW_ywa0wIqx-2-w
3. https://www.youtube.com/playlist?list=PLPpCFgQP7QKFAcYY2qzLbzQffG4WjnALn
4. https://www.youtube.com/playlist?list=PLPpCFgQP7QKGLh0E_GU9fHs7YL-R6941u
5. https://www.youtube.com/playlist?list=PLPpCFgQP7QKFrkYIYaZt0idq7ocZq9AYU

Course Outcomes (COs):

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

1. Analyse the performance of single phase and three phase transformers (PO-1, PO-10, PSO-1, PSO-3)
2. Differentiate the single phase and three phase transformers (PO-1, PO-10, PSO-1, PSO-3)
3. Analyse the performance of three phase Induction motors (PO-1, PO-10, PSO-1, PSO-3)
4. Aanalyse the performance of synchronous machines (PO-1, PO-10, PSO-1, PSO-3)
5. Classify the single phase induction motors. (PO-1, 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, CO5
Internal Test-II	30	CO3, CO4
Average of the two internal test will be taken for 30 marks		
Other components		
Assignment / Simulation / Term Paper	10	CO1, CO2, CO3, CO4, CO5
Quiz	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

DIGITAL ELECTRONICS LAB	
Course Code: EEL36	**Credits: 0:0:1**
Pre – requisites: Nil	**Contact Hours: 14P**
Course Coordinator: Dr. S. Dawnee	

Sl. No.	List of Experiments
1	Simplification, realization of Boolean expressions using logic gates
2	Realization of half/full adder and half/full subtractor using logic gates
3	Realization of parallel adder/subtractor using 7483 chip and BCD to Excess 3 code conversion and vice versa
4	Realization of binary to gray code converter and vice versa
5	Use of MUX/DEMUX for arithmetic circuit and code converter
6	Realization of one/two bit comparator and study of 7485 magnitude comparator
7	Truth table verification of flip-flops (JK, T and D type)
8	Realization of 3-bit counters as a sequential circuit and mod-n counter design
9	Shift left and shift right, SIPO, SISO, PISO, PIPO operations using 7495
10	Design and testing of Ring Counter/ Johnson counter
Virtual Lab Experiments	
1	Analysis of Functions of BCD-TO-7-segment Decoder / Driver and Operation of 7-segment LED Display http://vlabs.iitkgp.ernet.in/dec/exp1/index.html
2	Analysis and Synthesis of Boolean Relations using Digital Comparators http://vlabs.iitkgp.ernet.in/dec/exp6/index.html

Course Outcomes (COs):

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

1. Learn functioning, design and implement digital circuits using logic gates, decoders, multiplexers, flipflops etc. (PO-4, PSO-1)
2. Enhance their technical and communication skills and demonstrate team spirit with mini project. (PO-9, PO-10, PSO-4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Lab Internals	20	CO1, CO2, CO3, CO4, CO5
Record+ Observation	20	CO1, CO2, CO3, CO4, CO5
Other components		
MCQ	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4, CO5

ELECTRONIC DEVICES AND CIRCUITS LAB	
Course Code: EEL37	**Credits: 0:0:1**
Pre – requisites: Nil	**Contact Hours: 14P**
Course Coordinator: Dr. Ramakrishna Murthy. K	

Sl. No.	Laboratory Experiments
1.	Design and implementation of Clippers and clampers using Op-Amp
2.	Design, build and test MOSFET amplifier with given specifications and obtain its frequency response
3.	Design and implementation of half wave and full wave rectifier using Op-Amp
4.	Design and implementation of Square wave generator, triangular wave generator and Wein Bridge Oscillators using Op-amp
5.	Design and implementation of voltage follower, inverting amplifier, non - inverting amplifier and inverting summing amplifier using Op-amp
6.	Design and implementation of the following Active filters i. First order low pass filter ii. Second order low pass filter
7.	Design and implementation of the following Active filters i. First order high pass filter ii. Second order high pass filter
8.	Design and implementation of zero crossing detector, inverting and non-inverting voltage level detector using Op-Amp
9.	Design and implementation of differentiator and integrator using op-Amp
10.	Design and implementation of Monostable and Astable Multivibrator using 555 timer
Virtual Lab Experiments	
11.	Realization of function generator using operational amplifier through Virtual Lab https://ae-iitr.vlabs.ac.in/exp/function-generator/procedure.html
12.	Studies on BJT CE Amplifier through Vitrual lab http://vlabs.iitkgp.ac.in/be/exp13/index.html#

Web links and Video Lectures (e-Resources):

1. http://vlabs.iitkgp.ac.in/be/index.html
2. https://ee-iitb.vlabs.ac.in/index.html

Course Outcomes (COs):

At the end of the course students are able to:

1. Analyse the performance of clippers and clampers. (PO-1, PO-2, PO-4, PSO-1)
2. Analyse the performance of different rectifiers. (PO-1, PO-2, PO-4, PSO-1)
3. Analyse the performance of amplifiers and signal generators. (PO-1, PO-2, PO-4, PO-5, PSO-1, PSO-2)
4. Evaluate the performance of different active filters. (PO-1, PO-2, PO-4, PSO-1)
5. Analyse the performance of different multivibrators using 555 timer. (PO 1, 2, 4) (PSO 1)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Weekly evaluation of laboratory Record / reports after the conduction of every experiment	30	CO1, CO2, CO3, CO4, CO5
Practical Test	20	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4, CO5

UNIVERSAL HUMAN VALUES	
Course Code: UHV38	**Credits: 2:0:0**
Pre – requisites: Nil	**Contact Hours: 28L**
Course Coordinator: Dr. Binshati Chatterjee	

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

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- 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.
- Case studies of typical holistic technologies, management models and production systems
- 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)	100	CO1, CO2, CO3, CO4, CO5

ABILITY ENHANCEMENT COURSE - III	
Course Code: EEAEC39	**Credits: 1:0:0**
Pre – requisites: Nil	**Contact Hours: 14L**
Course Coordinator: Dr. Rama Shivakiran Reddy	

Ability Enhancement Courses (AEC) are the generic skill courses which are basic and needed by all to pursue any career. These courses are designed to help students enhance their skills in communication, language, and personality development. They also promote a deeper understanding of subjects like social sciences and ethics, culture and human behaviour, human rights and the law.

Every student shall register for AEC course under the supervision of his/her proctor. For III, IV & V semester, the student shall select the Ability Enhancement Course online such that the selected course does not overlap with any professional core/ elective course offered by the parent department of the student. After selection, the registration of the course has to be done by the student at his/her parent department.

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 (CO's):

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 8^{th} 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: EE41	**Credits: 2:0:1**
Pre – requisites: Nil	**Contact Hours: 28L+14P**
Course Coordinator: Dr. Monica Anand & Dr. Uma M	

Course Content

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, PSO-3)
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, PSO-3)
3. Find parameters of continuous probability distributions and calculate the marginal and conditional distributions of bivariate random variables (PO-1, PO-2, PSO-1, PSO-3)
4. Determine the parameters of stationary random processes and use Markov chain in prediction of future events. (PO-1, PO-2, PSO-1, PSO-3)
5. Choose an appropriate test of significance and make inference about the population from a sample. (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	**Marks**	**Course outcomes addressed**
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION	
Course Code: EE42	**Credits: 3:0:1**
Pre – requisites: Nil	**Contact Hours: 42L+14P**
Course Coordinator: Dr. S. Poornima	

Course Content

Unit I

Introduction

Review of fundamental and derived units; SI units; Dimensional equation; Requirements of instruments; types of analog Measuring instruments; essential features of indicating instruments; static and dynamic characteristics of instruments including Accuracy, precision, types of errors, error bands and measurement standards. Calibration - Introduction, Principles of Calibration.

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation.
- Links to online lectures: https://www.youtube.com/watch?v=ZtBKC6WSjD0
  https://www.youtube.com/watch?v=L9wHaLyv94Q
  https://www.youtube.com/watch?v=DFdTRPUwK_I

Unit II

Analog Measurement

Wheatstone bridge, Kelvin double bridge, Megger, Maxwell's Bridge, Anderson Bridge, Schering Bridge for circuit constants; shunt, multipliers current and potential transformers for voltage and current; Wien's bridge, Weston frequency meter for frequency, Electrodynamometer wattmeter and Power factor meter for single phase and three phase power and pf; single phase induction type energy meter; Phase sequence indicator

- Pedagogy/Course delivery tools: Chalk and Talk.
- Links to online lectures: https://www.youtube.com/watch?v=jt_0upfSH0M
  https://www.youtube.com/watch?v=qrodNBRX4n8

Unit III

Digital Measurement

Introduction to electronic Instrumentation, DAC & ADC ; Q-meter ; Digital voltmeters (DVM) - Ramp type DVM, Integrating type DVM, and Successive - approximation DVM ; Multimeter, LCR meter for circuit constants; Digital energy meter; Digital CRO for Phase and frequency.

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Links to online lectures: https://www.youtube.com/watch?v=1qQY54MQofs
  https://www.youtube.com/watch?v=AtnOK7EEEZU

Unit IV
Transducers

Classification and Selection of Transducers, characteristics; Strain Gauge, LVDT, RTD, Thermistor, Thermocouples; Sensors: basics, classification, general architecture of smart sensors, Interfacing techniques, Applications of ultrasonic sensors, IR sensor.

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Links to online lectures: https://www.youtube.com/watch?v=anCnrtjNLQM
  https://www.youtube.com/watch?v=o0LLV5GP6Ow
  https://www.youtube.com/watch?v=5b5xJu8KYrc

Unit V
Data Acquisition Systems

Introduction to Data Acquisition Systems, Electronic devices for signal sampling and quantification, Components of Digital and Analog Data Acquisition Systems; Design of DAS; Virtual instrumentation: Introduction, traditional and virtual measurements, Hardware and software, applications. Case studies on real time DAS Data Acquisition with LabVIEW, Computer based data acquisition, Virtual Instruments using NI LabVIEW

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Links to online lectures: https://www.youtube.com/watch?v=WwQSfk6SSSo
  https://www.youtube.com/watch?v=r79bPs5457A
  https://www.youtube.com/watch?v=cSbTp-XjzeY

List of Experiments:

1. Measurement of AC and DC currents: using Analog and digital instrument
2. Measurement of AC impedance and DC resistance using Bridges
3. Measurement of AC and DC Power: Analog and digital instrument
4. Measurement of PV cell output
5. Temperature measurement using RTD and Thermistor
6. Resolution analysis on IR sensor/proximity/ ultrasound sensor using a standard DAQ kit.
7. Measurement of phase shift and frequency using oscilloscope.
8. Measurement of vibration using Piezo-electric transducer.

Text Books:

1. A. K. Sawhney, Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Sons, 2011.
2. D. Patranabis, Sensor & transducers, PHI Learning, 2005.
3. Jovitha Jerome, Virtual Instrumentation using Labview, PHI Learning, 2010

Reference Books:

1. Golding and Widdies, Electrical Measurements and Measuring Instruments, Wheeler Publications, 5th Edition.
2. Harris, Electrical Measurements, John Wiley, 2nd Edition
3. R.K. Rajput, Electrical Measurements and measuring Instruments, S. Chand, 2008
4. Alan Morris, Reza Langari, 'Measurement and Instrumentation: Theory and Application', Elsevier, 3rd Edition - September 2, 2020.

Web links for video lectures (e-Resources):

1. https://www.youtube.com/watch?v=3eYmFjHnQjY&list=PLbRMhDVUMngcoKrA4sH-zvbNVSE6IpEio (NPTEL series)
2. http://a.impartus.com/ilc/#/course/2267122/1174

Course Outcomes (COs):

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

1. Derive units of any physical parameters based on the equations governing that physical parameter. (PO-1) (PSO -1, 3)
2. Find the values of Unknown electrical parameters by using different technologies. (PO-1) (PSO -1, 3)
3. Decide the type of transducer/sensor and measuring devices to be selected for a data acquisition system. (PO -1, 2, 4, 10, 11, 12) (PSO -1, 2, 4)

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	CO2, CO3
Average of the two internal test will be taken for 30 marks		
Other components		
Experiment report	10	CO2, CO3
Quiz	10	CO1, CO2, CO3
Semester End Examination (SEE)	100	CO1,CO2,CO3

FIELD THEORY	
Course Code: EE43	**Credits: 3:0:0**
Pre – requisites: Nil	**Contact Hours: 42L**
Course Coordinator: Dr. Pradipkumar Dixit/ Sri. Victor George	

Course Content

Unit I

Electrostatics

Coulomb's Law, Electric field intensity, Field of a line charge, Sheet of Charge, Electric flux density, Gauss's law, Divergence, Maxwell's First equation (Electrostatics), Vector operator ▽ and divergence theorem, Applications.

- Pedagogy/Course delivery tools: Chalk and Talk
- Link for Electrostatics: https://www.youtube.com/watch?v=PMpoamNGceM https://www.youtube.com/watch?v=eXpy5hQpA2Q

Unit II

Potential and Current

Definition of potential difference and potential, Potential gradient, Current and current density, Continuity of current, Boundary conditions**,** Applications

- Pedagogy/Course delivery tools: Chalk and Talk
- Video link for Potential: https://youtu.be/JhTT-wew-OE

Unit III

Poisson's and Laplace's equations

Derivations of Poisson's and Laplace's Equations, Solutions of Laplace's and Poisson's equations (one dimensional potential variation only), Capacitance, Examples.

Steady Magnetic field

Biot-Savart law, Ampere's circuital law, Curl, Applications.

- Pedagogy/Course delivery tools: Chalk and Talk
- Video link for Poisson's equations: https://youtu.be/AhctWTBzTfs
- Video link for Steady magnetic field https://youtu.be/ebGM_q19gY0

Unit IV

Magnetic forces Magnetic flux and flux density, Force on a moving charge and differential current element, Force between differential current elements, Force and torque on a closed circuit, Applications.

- Pedagogy/Course delivery tools: Chalk and Talk
- Video link for magnetic forces: https://youtu.be/aYRBXI63Oqk

Unit V

Time varying fields and Maxwell's equations

Inductance, Faraday's law, Displacement current, Maxwell's equation in point and integral form, Wave propagation in free space, Applications.

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Video link for Displacement current: https://youtu.be/dd9cZ8pU7O0
- Video link for Faraday's Law: https://youtu.be/mfVYhV-uptU
- Video link for Maxwell's equation: https://youtu.be/xxIb9Qv6t7E

Web links for video lectures (e-Resources):

1. https://nptel.ac.in/courses/108104087
2. http://a.impartus.com/ilc/#/course/81453/295

Text book:

1. William H Hayt Jr. and John A Buck, *Engineering Electromagnetic*, Tata McGraw-Hill, 7th Edition, 2009

Reference Books:

1. John Krauss and Daniel A Fleisch, *Electromagnetics with Applications*, McGraw-Hill, 5th Edition 1999.
2. Matthew N.O. Sadiku, *Elements of Electromagnetics*, Oxford University Press, 3rd Edition, 2004.

Course Outcomes (COs):

A student completing this course should be able to:

1. Determine force, torque, electric filed, potential and potential gradient due to static and moving charges (PO-1, PO-2, PO-10, PO-12, PSO-1, PSO-3)
2. Analyze electric and magnetic fields using divergence, curl, gradient and Laplacian operators (PO-1, PO-2, PSO-1)
3. Realize boundary relations of electric field components between different medium. (PO-1, PO-2, PO-12, PSO-1, PSO-3)
4. Determine magnetic field, current and current density using Biot-Savart law and, Ampere's law. (PO-1, PO-2, PSO-1)
5. Apply Maxwell's equations for static and time varying fields. (PO-1, PO-2, PO-3, PO-6, PO-12, 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
Average of the two internal test will be taken for 30 marks		
Other components		
Assignment	10	CO4, CO5
Quiz	10	CO2, CO3
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

MICROCONTROLLERS PROGRAMING & INTERFACING	
Course Code: EE44	**Credits: 3:0:0**
Pre – requisites: Nil	**Contact Hours: 42L**
Course Coordinator: Sri. Vinayak V Rao/ Dr. Kodeeswara Kumaran G	

Course Content

Unit I

Introduction to microcontrollers, Comparison of microcontroller and microprocessors, Microcontroller types, General resources available in microcontrollers, RISC and CISC architecture.

Review of Numbering Systems and Binary Arithmetic.

8051: Architecture, Pin Configuration, Oscillator and Clock, Internal and External memory, Program Counter, Data Pointer, CPU registers, Program Status Word, Flags, Stack, Stack Pointer, Special Function Registers.

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for 8051architecture: https://www.youtube.com/watch?v=hZDReT0vzBU

Unit II

8051-Assembly Language Programming: Addressing modes, Instruction Set - Data Movement Instructions, Arithmetic & Logic Instructions, Program Control Instruction. Simple Programs

- Pedagogy/Course delivery tools: Chalk and Talk
- Link for microcontrollers instruction sets: https://www.youtube.com/watch?v=MZD1gXsW_Ys

Unit III

8051 Programming I/O Programming, Timer Programming, Counter Programming, Serial Port Programming (Only C programmes)

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for Timer/counter concepts: https://www.youtube.com/watch?v=dM2swIpGk0Y
- Link for serial communication concepts: https://www.youtube.com/watch?v=8zOOi6gtWkY

Unit IV

Interrupt Programming in C language. Seven Segment Display Interfacing, Keypad Interfacing, External Memory Interfacing, ADC/DAC Interfacing (Only C programmes)

Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation

- Link for interrupt programming: https://www.youtube.com/watch?v=BUS9ppxf-ic
- Link for ADC/DAC interfacing with 8051: https://www.youtube.com/watch?v=yFIiJ6bJUNE

Unit V

Introduction to Embedded Systems: Components of Embedded System, Classification, Device drivers and its functions, Operating systems goals and structure, RTOS Services & its necessity for an embedded systems.

Embedded Programming- Advantages and disadvantages

- Pedagogy/Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for introduction to embedded system: https://www.youtube.com/watch?v=0fSqoVwBj60&list=PLp6ek2hDcoNAxTQ7uyp68N_RpuULV-zrX

Web links for video lectures (e-Resources):

1. NPTEL videos
2. https://www.youtube.com/watch?v=SUusup7FfJo
3. https://www.youtube.com/watch?v=uFhDGagZzjs

Course Outcomes (COs):

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

1. Identify the different functional units of a microcontroller and explain their functionality (PO-1, PSO-1)
2. Develop algorithm and write assembly language programs for a given specification (PO-2, PSO1-)
3. Develop algorithm and write 8051-C programs for a given specification (PO-1, PO-3, PSO-1)
4. Describe the function of 8051 peripherals and use it for their system design requirements (PO-3, PO-12, PSO-1).
5. Explain the basics of the embedded systems. (PO-1, 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
Average of the two internal test will be taken for 30 marks		
Other components:		
Assignment	5	CO4, CO5
Quiz	10+5	CO2, CO3
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

ELECTRIC NTEWORKS	
Course Code: EE45	**Credits: 2:1:0**
Pre – requisites: Nil	**Contact Hours: 28L+14T**
Course Coordinator/s: Dr. Hemachandra Gudimindla/ Dr. Sridhar. S	

Course Content

Unit I

Introduction

Practical sources (Dependent& Independent), Source transformation, Network reduction using start-delta transformation, Loop and node analysis with linearly independent sources for DC and AC network, Concepts of super node and super mesh

- Pedagogy / Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for Source transformation: https://www.youtube.com/watch?v=HO3Ek6QIlBU
- Link for concept super node: https://www.youtube.com/watch?v=XO1cGlsYFT4
- Link for concept for super mesh: https://www.youtube.com/watch?v=2pStuMpHVZw

Unit II

Network Theorems

Superposition, Reciprocity, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Millman's theorem

- Pedagogy / Course delivery tools: Chalk and Talk
- Link for problems on thevenin's theorem: https://www.youtube.com/watch?v=veAFVTIpKyM
- Link for Superposition theorem: https://www.youtube.com/watch?v=ZJ8zD8m-B1Q
- Link for Maximum Power Transfer Theorem: https://www.youtube.com/watch?v=U85eA3-suiQ

Unit III

Transient behavior and initial conditions

Behavior of circuit element under switching condition and their representation, Evaluation of initial and final conditions in RL, RC and RLC circuit for DC excitations

- Pedagogy / Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for Initial and final conditions of electric circuits:

https://www.youtube.com/watch?v=TquA_f0Ps94

- Link for Initial and final conditions of parallel RC electric circuits: https://www.youtube.com/watch?v=73RBroaIefg

Unit IV

Laplace transformation (LT)

LT of Impulse, Step, Ramp, Sinusoidal signals and shifted functions. Waveform synthesis. Initial and Final value theorems. Laplace Transform of network and time domain solution for RL, RC and RLC networks for DC excitations.

- Pedagogy / Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for Analysis of RL using Laplace transforms: https://www.youtube.com/watch?v=kjWo2naI1go
- https://www.youtube.com/watch?v=K4TL_HaRZhQ
- Link for Analysis of RC using Laplace transforms: https://www.youtube.com/watch?v=bjD-7E9rKHo

Unit V

Resonant circuits

Series and parallel resonance, frequency response of series and parallel circuits, Q factor and bandwidth.

Three phase circuits: Analysis of balanced and unbalanced three phase systems, Measurement of active and reactive power (with balanced system), Advantages of polyphase system over single phase system.

- Pedagogy / Course delivery tools: Chalk and Talk, Power Point Presentation
- Link for introduction to balanced and unbalanced three phase system: https://www.youtube.com/watch?v=nRzsH0plXIc

Text Books:

1. Kanaan Kano *"Semiconductor Devices"*, Pearson Education, 2006 (for Topic Metal Oxide Semiconductor FET)
2. David A Bell, "*Operational amplifiers and Linear IC's*", Prentice Hall, 2nd Edition. (For the following topics: Introduction to Operational amplifier, OP-AMP as D.C. Amplifier, Signal Processing circuits)
3. Ramakant A Gayakwad, "*Op-Amps and Linear Integrated Circuits*", Prentice Hall, 4th Edition. (For the topics: Active Filters, Signal Generators, Op-Amp with negative feedback, Integrators and differentiators, Specialized IC Applications)
4. Robert F Couglin, Frederick F Driscoll, "*Operational Amplifiers and Linear Integrated Circuits*", Prentice Hall, 6th Edition. (For the topic: Comparators)

Reference Books:

1. Sergio Franco, "*Design with Operational Amplifiers and Analog Integrated Circuits*", TMC, 2008.
2. Roy Choudhary, "*Linear Integrated Circuits*", New Age International, 2003.
3. J. Nagarath, "*Electronic Devices & Circuits*", PHI, 2007.
4. Sudhaker Samuel, "*Electronic Circuits*", 2nd Edition, Tata McGraw Hill, 2010.

Web links for video lectures (e-Resources):

1. https://nptel.ac.in/courses/108108111
2. https://a.impartus.com/ilc/#/course/1253714/1112

Course Outcomes (COs):

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

1. Analyze VI characteristics of MOSFET and designing biasing circuit for MOSFET (PO 1,3, 4) (PSO 1)
2. Analyse various electrical characteristics of different IC's through interpretation of their data sheets. (PO 1, 3, 4) (PSO 1)
3. Design linear & non linear circuits for different functionality using Op-Amp (PO 1, 2, 3) (PSO 1)
4. Analyse linear & non linear circuits for different functionality using Op-Amp (PO 1, 2, 3) (PSO 1)
5. Illustrate the function of application specific ICs such as 555 timer and Voltage regulators (PO 1, 2, 3) (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
Average of the two internal test will be taken for 30 marks		
Other components		
Assignment	10	CO4, CO5
Quiz	10	CO2, CO3
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

MICROCONTROLLERS & APPLICATIONS LAB	
Course Code: EEL46	**Credits: 0:0:1**
Pre – requisites: Nil	**Contact Hours: 14P**
Course Coordinator: Sri. Vinayak V Rao/ Dr. Kodeeswara Kumaran G	

Sl. No.	**List of Experiments**
1	Assembly language programs for data movement with and without overlap, exchange
2	Assembly language programs for linear search, palindrome, Fibonacci series
3	Assembly language programs for sorting numbers, finding largest/smallest Numbers in a series and for code conversion
4	C language programs for generating waveforms
5	C language programs for I/O Ports
6	C language programs for timers and counters
7	C language programs for serial communications
8	C language programs for interrupts.
9	Hardware implementation of Blinking LED in a particular sequence
10	Hardware implementation of seven segment display control using 8051 Microcontroller
11	Hardware implementation of 9V DC motor control using 8051 Microcontroller
Virtual Lab Experiments	
1	Interfacing with various display devices http://vlabs.iitb.ac.in/vlabs-dev/labs/8051-Microcontroller-Lab/labs/index.php
2	Interfacing with ADC and DAC http://vlabs.iitb.ac.in/vlabs-dev/labs/8051-Microcontroller-Lab/labs/index.php

Course Outcomes (COs):

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

1. Develop an algorithm that will enable the student to write 8051 programs. (PO-1, PO-2, PO-4, PSO-1, PSO-2)
2. Write, simulate and debug 8051 assembly/C programs for a given problem statement. (PO-1, PO-2, PO-4, PSO-1, PSO-2)
3. Create a hex file, program the microcontroller and conduct a hardware experiment. (PO-1, PO-4, PSO-1, PSO-2)
4. Design and implement a simple 8051 microcontroller based system, in a group to solve an engineering design problem. (PO-3, PO-4, PSO-4)

Course Assessment and Evaluation:

Continuous internal evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Lab Internals	20	CO1, CO2, CO3, CO4
Record+ Observation	20	CO1, CO2, CO3, CO4
Other components		
MCQ	10	CO1, CO2, CO3, CO4
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4

ELECTRICAL AC MACHINES LABORATORY	
Course Code: EEL47	**Credits: 0:0:1**
Pre – requisites: Nil	**Contact Hours: 14P**
Course Coordinator: Dr. Chandrashekhar Badachi/ Dr. Nagaraj. C	

Sl. No.	**List of Experiments**
1	Open circuit and short circuit tests on a 1- Φ transformer.
2	Load test on 1- Φ transformer direct loading
3	Sumpner's test or back to back test on a pair of 1- Φ transformers.
4	Parallel operation and load sharing of 1- Φ transformers.
5	Equivalent circuit & Circle diagram of 3- Φ induction motor.
6	Load test on 3- Φ induction motor.
7	Speed control of 3- Φ induction motor
8	Experiment on 3- Φ induction generator.
9	Predetermination of % regulation of 3-Φ Alternator by EMF method.
10	Predetermination of % regulation of 3-Φ Alternator by ZPF method.
11	Slip test on 3-Phase synchronous machine.
12	Load test on 1- Φ induction motor.
Virtual Lab Experiments	
1	V-curves and Inverted-V curves of a 3-Φ Synchronous motor by virtual lab (http://emcoep.vlabs.ac.in/Exp8/Procedure.html?domain=Civil%20Engineering&lab=Electrical%20Machines)
2	Predetermination of % regulation of 3-Φ Alternator by MMF method by virtual lab (http://emcoep.vlabs.ac.in/Exp5/Procedure.html?domain=Civil%20Engineering&lab=Electrical%20Machines) (http://emcoep.vlabs.ac.in/Exp6/Procedure.html?domain=Civil%20Engineering&lab=Electrical%20Machines)

Web links and Video Lectures (e-Resources):

1. http://vlabs.iitkgp.ac.in/be/index.html
2. https://ee-iitb.vlabs.ac.in/index.html

Course Outcomes (COs):

At the end of the course students are able to:

1. Analyze the performance of single phase transformer. (PO-1, PO-4, PO-9, PO-10) (PSO-1, PSO-3, PSO-4)
2. Determine the performance of single phase induction motor. (PO-1, PO-4, PO-9, PO-10, PSO-1, PSO-3, PSO-4)
3. Analyze the performance characteristics of three phase induction machine (PO-1, PO-4, PO-9, PO-10, PSO-1, PSO-3, PSO-4)
4. Predetermine the regulation of a 3-Phase Alternator by different methods. (PO-1, 4,9,10) (PSO-1,3,4)
5. Demonstrate the speed control of 3-Phase induction motor (PO1,9,10), (PSO-1,3,4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Lab Internals	20	CO1, CO2, CO3, CO4, CO5
Record+ Observation	15+05	CO1, CO2, CO3, CO4, CO5
Other components		
MCQ	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4, CO5

INTRODUCTION TO PRODUCT DESIGN LAB	
Course Code: EEL48	**Credits: 0:0:1**
Pre – requisites: Nil	**Contact Hours: 14P**
Course Coordinator: Dr. Kodeeswara Kumaran G / Dr. Ramakrishna Murthy K	

Course Contents

This course is an extension of Design Thinking and introduces the students to a detailed process of Engineering Design. Students will work in a group of 3/4 to solve a problem of current concern requiring an engineering solution. They are required to follow a systematic approach towards developing the solution by considering technical and non-technical factors. The working model of the solution along with the design documentation will be considered for final evaluation.

References:

1. https://resources.saylor.org/wwwresources/archived/site/wp-content/uploads/2012/09/ME101-4.1-Engineering-Design-Process.pdf
2. *http://ocw.mit.edul*

Course Outcomes (COs):

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

1. Define the problem to be solved in a clear and unambiguous terms.(PO-1, PSO-1)
2. Identify and establish the need to solve the problem by gathering relevant literature. (PO-1, PSO-3)
3. Generate multiple solutions, analyze and select one solution. (PO-3, PO-4, PO-5, PSO-1)
4. Test and implement the solution as a team. (PO-9, PO-10, PSO-2, PSO-4)
5. Document and present the solution to the peer group. (PO-10, PO-12, PSO-3, PSO-4)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Documentation (Record)	20	CO1, CO2, CO3, CO4, CO5
Quiz	10	CO1, CO2, CO3, CO4, CO5
Demonstration	20	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4, CO5

ABILITY ENHANCEMENT COURSE - IV	
Course Code: EEAEC49	**Credits: 2:0:0**
Pre – requisites: Nil	**Contact Hours: 14L**
Course Coordinator: Dr. Rama Shivakiran Reddy	

Ability Enhancement Courses (AEC) are the generic skill courses which are basic and needed by all to pursue any career. These courses are designed to help students enhance their skills in communication, language, and personality development. They also promote a deeper understanding of subjects like social sciences and ethics, culture and human behaviour, human rights and the law.

Every student shall register for AEC course under the supervision of his/her proctor. For III, IV & V semester, the student shall select the Ability Enhancement Course online such that the selected course does not overlap with any professional core/ elective course offered by the parent department of the student. After selection, the registration of the course has to be done by the student at his/her parent department.

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

Course Contents

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.