INSTITUTE VISION

"To be a preferred institution in Engineering Education by achieving excellence in teaching and research and to remain as a source of pride for its commitment to holistic development of individual and society"

INSTITUTE MISSION

"To continuously strive for the overall development of students, educating them in a state of the art infrastructure, by retaining the best practices, people and inspire them to imbibe real time problem solving skills, leadership qualities, human values and societal commitments, so that they emerge as competent professionals"

DEPARTMENTAL VISION

“To be the centre of excellence in providing education in the field of Electronics and Communication Engineering to produce technically competent and socially responsible engineering graduates.”

DEPARTMENTAL MISSION

“Educating students to prepare them for professional competencies in the broader areas of the Electronics and Communication Engineering field by inculcating analytical skills, research abilities and encouraging culture of continuous learning for solving real time problems using modern tool”.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO1:

Acquire core competence in Applied Science, Mathematics, and Electronics and Communication Engineering fundamentals to excel in professional carrier and higher study.

PEO2:

Design, Demonstrate and Analyze the Electronic Systems which are useful to society.

PEO3:

Maintain Professional and Ethical values, Employability skills, Multidisciplinary approach and an Ability to realize Engineering issues to broader social contest by engaging in lifelong learning.

PROGRAM SPECIFIC OUTCOMES(PSOS)

The graduates will be able to:

PSO1:

An ability to understand the concepts of Basic Electronics and Communication Engineering and to apply them to various areas like Signal Processing, VLSI, Embedded Systems, Communication Systems and Digital & Analog Devices

PSO2:

An ability to solve complex Electronics and Communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive at cost effective and appropriate solutions

PROGRAM OUTCOMES (POs):

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **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.
3. **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.
4. **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.
5. **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.
6. **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.
7. **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.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **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.
12. **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.

STUDENT HELP DESK

Sl. No	Name of the faculty	Activities
1	Dr. M. C. Sarasamba	GATE / Pre placement Coaching
		Students Mentor
		Module Coordinator
		Research Center Coordinator
		Dept. NAAC Criteria Sub Coordinator
		NBA Criteria Coordinator
2	Dr. S. S. Ittannavar	Dean Students Welfare
		GATE / Pre placement Coaching
		BSP /DSP Lab In charge
		Students Mentor
		Module Coordinator
		ISTE Convener & Dept. Coordinator
		NBA /NAAC Criteria Coordinator
		AICTE Coordinator
3	Dr. B. I. Kattimani	GATE / Pre placement Coaching
		NBA Criteria Coordinator
		Module Coordinator
		Students Mentor
		Internship Coordinator
		Communication Lab In charge
4	Prof. S. S. Malaj	GATE / Pre placement Coaching
		Adv. Comm. Lab In charge
		Central Counseling Coordinator
		Students Mentor
		NAAC Criteria Sub Coordinator
		NBA Criteria Coordinator
		Library Committee Member
		NIRF Coordinator
5	Prof. S. S. Kamate	GATE / Pre placement Coaching
		VLSI Lab In charge
		Students Mentor
		Module Coordinator
		IEEE Coordinator/ IA Coordinator
		Dept. NAAC Criteria Sub Coordinator
		Project Coordinator
		Class Teacher VI Sem
		NBA Criteria Coordinator

Sl. No	Name of the faculty	Activities
6	Prof. D. M. Kumbhar	GATE / Pre placement Coaching
		IOT Lab In charge
		Students Mentor
		Dept. Association Coordinator
		Class Teacher III Sem A Div
		IIIC Coordinator
		Dept. NAAC Criteria Sub Coordinator
		NBA Criteria Coordinator
		Institute & Dept. ED Cell Coordinator
7	Prof. S. S. Patil	GATE / Pre placement Coaching
		ARM & ES Lab In charge
		Students Mentor
		NAAC Criteria 7 Convener
		NBA Criteria Coordinator
		Admission Coordinator
		Module Coordinator
8	Prof. D. B. Madihalli	GATE / Pre placement Coaching
		DSD Lab In charge
		UHV Coordinator
		Students Mentor
		NBA / NAAC Coordinator
		News & Publicity Coordinator
		NBA Criteria Coordinator
		Website Coordinator
		VTU LIC Coordinator
9	Prof. P. V. Patil	GATE / Pre placement Coaching
		E- Yantra Lab In charge
		Students Mentor
		NBA /NAAC Criteria Coordinator
		Dean TP & IIIC Cell
		SPOC PMV & PMKEY
		Alumni Coordinator

Sl. No	Name of the faculty	Activities
10	Prof. B. P. Khot	GATE / Pre placement Coaching
		MC Lab In charge
		Students Mentor
		Dept. Time Table Coordinator
		Dept. Meeting Coordinator
		Class Teacher VIII Sem
		NBA/NAAC Criteria Coordinator
		Dept T&P Cell Coordinator
		Seminar Coordinator
11	Prof. S. R. Mallurmath	EMS Coordinator
		ERP Coordinator
		GATE / Pre placement Coaching
		Students Mentor
		News Letter / Technical Magazine
		Class Teacher III Sem B Div
		NBA/NAAC Criteria Coordinator
12	Prof. K. S .Patil	GATE / Pre placement Coaching
		Students Mentor
		NBA /NAAC Criteria Coordinator
13	Prof. S. M. Patil	AICTE Activity Coordinator
		GATE / Pre placement Coaching
		Students Mentor
		EMS Coordinator
		NBA Criteria Coordinator

CONTENTS

DEPARTMENTAL RESOURCES

Department of Electronics and Communication Engineering was established in the year 1996 and is housed in total area of **1112.83 Sq. Mtrs**.

FACULTY POSITION

S.N.	Category	No. in position	Average experience
1	Teaching faculty.	10	18.64Y
2	Technical supporting staff.	03	24.02Y
3	Helper staff	02	23.03Y

MAJOR LABORATORIES

S. N.	Name of the laboratory	Area in Sq. Mtrs	Amount Invested in Lakhs	S. N.	Name of the laboratory	Area in Sq. Mtrs	Amount Invested in Lakhs
1	Digital Electronics Lab	71	1.54	5	VLSI Lab	71	39.03
2	Analog Electronics Lab	92	8.24	6	Project Lab	95	--
3	Advanced Commn & Commn + LIC Lab	92	20.01	7	Research/E-Yantra/DSP & C.N.Lab	71	12.15
4	HDL/MC / EMD Lab	71	22.61	8	Power Electronics Lab	--	4.86
Total Investment in The Department					**Rs. 109.09 Lacs**		

TEACHING FACULTY DETAILS

Sl. No.	Name	Designation	Qualification	Specialization	Professional Membership	Teaching Exp.	Contact No.
1	Dr. M. C. Sarasamba	Prof. & HOD	Ph.D	Micro strip Antenna	LMISTE	20Y.06M	9480714746
2	Dr. S .S .Ittannavar	Assoc. Prof	Ph.D	DSP	LMISTE	12Y.00M	9964299498
3	Dr. B. I. Kattimani	Assoc. Prof	Ph.D	Micro strip Antenna	LMISTE	16Y.00M	9060467209
4	Prof. S. S. Malaj	Asst. Prof	M.E.	E & TC	LMISTE	27Y.08M	9731795803
5	Prof. S. S .Kamate	Asst. Prof	M. Tech	Digital Electronics	LMISTE	22Y.01M	9008696825
6	Prof. D. M. Kumbhar	Asst. Prof	M. Tech	Electronics	LMISTE	21Y.00M	09373609880
7	Prof. S .S. Patil	Asst. Prof	M. Tech	VLSI & Embedded	LMISTE	20Y.09M	9448102010
8	Prof. D. B. Madihalli	Asst. Prof	M. Tech	Industrial Electronics	LMISTE	17Y.08M	9902854324
9	Prof. P. V. Patil	Asst. Prof	M. Tech	VLSI & Embedded	LMISTE	12Y.06M	9731104059
10	Prof. B. P. Khot	Asst. Prof	M. Tech	Microelectronics & Control Systems	--	9Y.00M	9964019501
11	Prof. S. R. Mallurmath	Asst. Prof	M. Tech	Industrial Electronics	LMISTE	12Y.00M	7259865769
12	Prof. K. S. Patil	Asst. Prof	M. Tech	VLSI	LMISTE	30Y.06M	9902682781
13	Prof. S. M. Patil	Asst. Prof	M. Tech	VLSI & EMD	--	02Y.00M	9986238640

TECHNICAL SUPPORTING STAFF

S.N.	Name	Qualification	Experience
1.	Sri. P. S. Desai	DEC	24Y-.07M
2.	Sri. M. A. Attar	DEC	14Y-09M
3	Sri. M.S. Byali	DEC	14Y-09M

SCHEME OF TEACHING AND EXAMINATION

IV SEM ECE

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
B.E. in Electronics and Communication Engineering
Scheme of Teaching and Examinations2022
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2023-24)

IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper-Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	BEC401	Electromagnetics Theory	TD: ECE /ETE PSB: ECE/ETE	3	0	0		03	50	50	100	3
2	IPCC	BEC402	Principles of Communication Systems	TD: ECE /ETE PSB: ECE/ETE	3	0	2		03	50	50	100	4
3	IPCC	BEC403	Control Systems	TD: ECE /ETE PSB: ECE/ETE	3	0	2		03	50	50	100	4
4	PCCL	BECL404	Communication Lab	TD: ECE /ETE PSB: ECE/ETE	0	0	2		03	50	50	100	1
5	ESC	BEC405x	ESC/ETC/PLC	TD: ECE /ETE PSB: ECE/ETE	3	0	0		03	50	50	100	3
6	AEC/ SEC	BXX456x	Ability Enhancement Course/Skill Enhancement Course- IV	TD and PSB: Concerned department	If the course is Theory 1	0	0		01	50	50	100	1
					If the course is a lab 0	0	2		02				
4	BSC	BBOK407	Biology For Engineers	TD / PSB: BT, CHE,	3	0	0		03	50	50	100	3
7	UHV	BUHK408	Universal human values course	Any Department	1	0	0		01	50	50	100	1
9	MC	BNSK459	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK459	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK459	Yoga	Yoga Teacher									
									Total	**500**	**400**	**900**	**20**

S J P N Trust's
Hirasugar Institute of Technology, Nidasoshi.
Approved by AICTE, New Delhi, Permanently Affiliated to VTU, Belagavi Recognized under 2(f) & 12B of UGC Act, 1956
Accredited at 'A+' Grade by NAAC & Programmes Accredited by NBA:CSE & ECE

IQAC
Institute CoE
AY:2024-25 (Even)
Rev: 03

INSTITUTE CALENDAR OF EVENTS (CoE)

AY: 2024-25 (Even Sems.: II , IV, VI & VIII) (w.e.f.: 10th Feb. 2025)

Ref: 1. VTU CoE Notifications No.: VTU/BGM/BoS/Academic Calendar/2024-25/5487 &5601, Dated :24th /29th Jan 2025
2. IQAC Meeting No.:HSIT/NDS/NAAC/IQAC/Meeting-Actions-Proceedings/2024-25/32, Dated: 29th Jan. 2025
3. VTU CoE Notifications No.: VTU/BGM/BoS/Academic Calendar/2024-25/6056, Dated :21st Feb. 2025

February -2025

Sun	Mon	Tue	Wed	Thu	Fri	Sat
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	

26th Feb. 2025 GH: Maha Shivaratri
27th Feb. 2025 LH: Mahadasoha of Shri. Math (UHV Program Org. by NSSD, DSCs & UHV Coordinator)

March-2025

Sun	Mon	Tue	Wed	Thu	Fri	Sat
30	31					1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

30th March 2025 GH: Yugadi Festival
31st March 2025 GH: Kutub-A-Ramjan
19th March 2025 LH: Rang Panchami (Tentative)

April -2025

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

10th April 2025 GH: Mahaveer Jayanti
14th April 2025 GH: Dr. B.R. Ambedkar Jayanti
18th April 2025 GH: Good Friday
30th April 2025 GH: Basav Jayanti/Aksay-Trutiya

May -2025

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

1st May 2025 GH: Labours Day

June -2025

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

Date	Events & Holidays
10th Feb. 2025	Commencement of IV & VI Sem Classes & COP in 1st Week
11th Fab. 2025	International Day of Women & Girls in Science (Org. by WEC)
15th Feb. 2025	Commencement of 15 Weeks Industry/Research Internship (For VIII Sem ME, EE & CV)
21st -22nd Feb. 2025	Major Project Synopsis Presentation Cum Idea Presentation (For VIII Sem. CSE & ECE, Org. by DAs & DSCs)
27th -28th Feb. 2025	Major Project (Phase-II, Synopsis Presentation Cum Idea Presentation (For VI Sem. all branches, Org. by DSCs)
28th Feb. 2025	National Science Day (Org. by FYD)
7th -8th March 2025	International Conference:ICRTET-25 (Org. by R&D Cell)
8th March 2025	International Women's Day (Org. by WEC & DSCs,)
12th-14th March 2025	1st IAT for IV & VI Sems. (On 01 CO/Module)
14th March 2025	1st Feedback on T&L Process by IV & VI Sems. Students.
17th March 2025	Commencement of Classes of II Sem & Student Induction Program (SIP) Phase-II (Tentative)
18th March 2025	Display of 1st IAT Marks of IV & VI Sems
20th March 2025	International Day of Happiness (Org. by NSSD & YRCD)
29th March 2025	Technovision-2025 (Host by CSE Dept. Org. by DSCs)
17th April 2025	Annual Sports Day (Host by: Sports Dept. & Org. by DSCs)
24th -26th April 2025	1st IAT for II Sem (On 01 CO/Module)& 2nd IAT for IV & VI Sems. (On 02 COs/ Modules covered after 1st IAT) (On 24th National Panchayathraj Day, Org. by NSSD & DSCs)
26th April 2025	1st Feedback on T&L Process by II Ses. Students. 2nd Feedback on T&L Process by IV & VI Sems. Students. (World Intellectual Property Day, Org. by DSCs, R&D Cell, ED Cell)
29th April 2025	1st Lab IAT for IV & VI Sems. (On 02 COs/5 Expts)
2nd May 2025	Display of 2nd /1st IA Test Marks of IV & VI/II Sems
8th -9th May 2025	HSIT-QUEST-2025 (Host by ME Dept. Org. by DSCs) (On 8th World Red Cross Day, Org. by YRC, DSCs)
10th May 2025	SEE of NSS/PE/YOGA for VIII Sem (2021 Scheme)
13th -14th May 2025	Technical Seminar Presentation. (For VIII Sem: All branches , Org. by DAs)
12th -16th May 2025	Fun Week (Social & Cultural Activities) (Org. by NSS Cell & Sports Dept., DSCs & Host by EEE Dept.)
16th -17th May 2025	Project Exhibition (VI: All Branches & VIII Sem: CS & EC) (Org. by DAs & DSCs)
15th May 2025	Last Working Day of VIII Sems
20th May 2025	HSIT Shambhrama-25 (Host by EEE Dept. Org. by DSCs)
21st May 2025	Graduation Day (Host by ECE Dept. Org. by DSCs)
26th -28th May 2025	2nd IAT for II Sem, (On 02 COs/ Modules covered after 1st IAT) 3rd IAT for IV & VI Sems, (On 02 COs/Modules covered after 2nd IAT)
28th May 2025	2nd Feedback on T&L Process by II Sem. Students.
30th May 2025	Display of 3rd /2nd IA Test Marks of IV & VI/II Sems
30th May 2025	2nd Lab IAT for IV&VI Sems. (On remaining 03 COs/5Expts)
31st May 2025	Last Working Day of IV & VI Sems (World Tobacco Day, Org. by DSCs, NSSD & YRCD)
2nd June 2025	Display of final CIE (IAT+CCA) marks
16th-26th May 2025	VTU Theory Examinations (SEE) (For VIII Sems.)
27th May -2nd June 2025	VTU Practical/Internship/Project Examinations (For VIII Sem.)
13th-15th June 225	Alumni Meet/Re-Union/Activities (Org. by AA)
2nd -13th June 2025	VTU Practical Examinations (For IV & VI Sems.)
23rd -25th June 2025	3rd IAT II Sem. (On 02 COs/Modules covered after 2nd IAT)
28th June 2025	Last Working Day of II Sem
30th June 2025	Display of 3rd Test Marks of II Sem.
16th June-1st Aug. 2025	VTU Theory Examinations (SEE) (For IV & VI Sems.)
1st July -11th July 2025	VTU Practical Examinations (For II Sem.)
14th July-9th Aug. 2025	VTU Theory Examinations (SEE) (For II Sem.)
4th Aug. 2025	Commencement of AY: 2025-26, III & V Sems.
One week	Evaluation of COs-POs-PSOs Attainments through Direct & Indirect Methods after SEE revaluation results
5th June 2025	World Environment Day/Plastic free Awareness & Pledge, Org. by NSSD
12th June 2025	World Blood Donor Day, Org. by DSCs, YRCD & NSSD
21st June 2025	International YOGA Day, Org. by DSCs, Sports Dept. & NSSD

GH: General Holiday LH: Local Holiday NSS: National Service Scheme WEC: Women Empowerment Cell R&D: Research & Development YRC: Youth Red Cross CO: Course Outcome PO: Program Outcome IAT: Internal Assessment Test SIP: Student Induction Program COP: Course Orientation Program AA: Alumni Association SEE: Semester End Exams DSC: Dept. Student Council DA: Dept. Association ED: Entrepreneurship Development T&L: Teaching & Learning

Dr. S. N. Topannavar
IQAC Coordinator
Hirasugar Institute of Technology
Nidasoshi 591236

Dr. S.C. Kamate
Professor & Principal
Hirasugar Institute of Technology,
NIDASOSHI-591236

Copy to all key authorities, displayed on N/Bs and circulated to all students through whatsapp groups

Nidasoshi, Taq: Hukkeri, Dist: Belgaum, Karnataka - 591 236
Phone No.:08333-278887, Fax:278886, Web: www.hsit.ac.in, Mail: principal@hsit.ac.in

FACULTY DETAILS:		
Name: Dr. B. I. Kattimani	**Designation:** Associate Professor	**Experience: 16**
No. of times course taught: 07	**Specialization:** E&C	

Subject Title	**Electromagnetic Theory**		
Subject Code	BEC401	**CIE Marks**	50
Number of Lecture Hrs / Week	03	**SEE Marks**	50
Total Number of Lecture Hrs	40	**Exam Hours**	03
CREDITS – 03			

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	ECE	I/II	Physics

2.0 Course Objectives

The objectives of this course is to introduce students to the mostly used analytical and numerical methods in the different engineering fields by making them to Electric and Magnetic fields, Maxwell's equations and wave propagation concepts

1. Define and Describe Coulomb's law and electric field intensity.
2. Define and explain electric flux density, Gauss's law and divergence.
3. Describe energy and potential along with concepts of current and conductors.
4. Describe Poisson's and Laplace's Equations, and Uniqueness Theorem.
5. Define and describe basic concepts of Magneto statics by studying the various laws,
6. Stoke's Theorem and scalar and vector magnetic flux density.
7. Explain Magnetic Forces, Materials and Inductance.
8. Describe the concepts of time varying fields and Develop Maxwell's equations in
9. Point and Integral Forms.
10. Describe and Compare Different Types of Wave Propagation.

	Course Outcome	**RBT Levels**	**POs**
C216.1	Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.	L1, L2 & L3	1,2,10,12
C216.2	Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge.	L1, L2 & L3	1,2,10,12
C216.3	Determine potential and energy with respect to point charge and capacitance using Laplace equation.	L1, L2 & L3	1,2,10,12
C216.4	Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.	L1, L2 & L3	1,2,10,12
C216.5	Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem.	L1, L2 & L3	1,2,10,12
Total Hours of instruction			**40**

4.0 Course Content

MODULES	RBT Levels	No. Of Hours
Module 1: Vector Analysis **Coulomb's Law, Electric Field Intensity and Flux density** Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Electric flux density Numerical Problems.	**L1, L2& L3**	**8**
Module 2: **Gauss's law and Divergence** Gauss 'law, Application of Gauss' law to point charge, line charge, Surface charge and volume charge, Point (differential) form of Gauss law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator ▼ and divergence theorem, Numerical Problems (**Text: Chapter 3.2 to 3.7).** **Energy, Potential and Conductors**: Energy expended or work done in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Potential gradient, Numerical Problems **(Text: Chapter 4.1 to 4.4 and4.6).**Current and Current density, Continuity of current. **(Text: Chapter 5.1, 5.2)**	**L1, L2& L3**	**8**
Module 3 **Poisson's and Laplace's Equations**: Derivation of Poisson's and Laplace's Equations, Uniqueness theorem, Examples of the solution of Laplace's equation, Numerical problems on Laplace equation. **(Text: Chapter 7.1 to 7.3)** **Steady Magnetic Field**: Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Basic concepts Scalar and Vector Magnetic Potentials, Numerical. Problems. (**Text: Chapter 8.1 to 8.6)**	**L1, L2& L3**	**8**
Module 4 **Magnetic Forces**: Force on a moving charge, differential current elements, Force between differential current elements, Numerical problems **(Text: Chapter 9.1 to 9.3).** **Magnetic Materials**: Magnetization and permeability, Magnetic boundary conditions, The magnetic circuit, Potential energy and forces on magnetic materials, Inductance and mutual reactance, Numerical problems **(Text: Chapter 9.6 to 9.7).** Faraday' law of Electromagnetic Induction –Integral form and Point form, Numerical problems **(Text: Chapter 10.1)**	**L1, L2& L3**	**8**
Module 5 **Maxwell's equations** Continuity equation, Inconsistency of Ampere's law with continuity equation, displacement current, Conduction current, Derivation of Maxwell's equations in point form, and integral form, Maxwell's equations for different media, Numerical problems **(Text: Chapter 10.2 to 10.4)** **Uniform Plane Wave**: Plane wave, Uniform plane wave, Derivation of plane wave equations from **L1, L2,L3** Maxwell's equations, Solution of wave equation for perfect dielectric, Relation between E and H, Wave propagation in free space, Solution of wave equation for sinusoidal excitation, wave propagation in any conducting media (**γ, α, β, η**) and good conductors, Skin effect or Depth of penetration, Poynting 's theorem and wave power, Numerical problems. **(Text: Chapter 12.1 to 12.4)**	**L1, L2& L3**	**8**

5.0 Relevance to future subjects

Sl. No.	Semester	Subject	Topics
1.	VI	Microwave and Antennas	Antenna impedance
2.	VI/VII	Project work	Antennas and communication

6.0 Relevance to Real World

SL. No.	Real World Mapping
01	Learnt methods are used to solve some field related engineering problems.
02	Losses in propagation due to different media, impedance of an Antenna

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Videos	Behavior of Electric and Magnetic Fields
02	NPTEL	Study Wave propagation

8.0 Books Used and Recommended to Students

Text Books

1. W.H. Hayt and J.A. Buck, —Engineering Electromagnetics, 8th Edition, Tata McGraw- Hill, 2014, ISBN-978-93-392-0327-6.

Reference Books

1. Elements of Electromagnetics – Matthew N.O., Sadiku, Oxford university press, 4thEdn.
2. Electromagnetic Waves and Radiating systems – E. C. Jordan and K.G. Balman, PHI, 2ndEdn.
3. Electromagnetics- Joseph Edminister, Schaum Outline Series, McGraw Hill.

N. Narayana Rao, —Fundamentals of Electromagnetics for Engineering, Pearson

Additional Study material & e-Books

1. Schaum's outline series "Electromagnetics" by Joseph A. Administer**.**
2. VTU on line notes.

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References

01) https://nptel.co.in
02) http://m.noteboy.in/vtuflies/machine%20drawing.pdf
03) https://www.edx.org/school/iitbombayx?utm_source=bing&utm_medium=cpc&utm_term=iit-bombay&utm_campaign=partner-iit-bombay

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	IJCOT - International Journal of Computer & Organization Trends	www.ijcotjournal.org/
2	Journals - The Science and Information (SAI) Organization	thesai.org/Publications
3	Computer Hardware Organizations Innovate with IEEE Information	https://www.ieee.org/documents/ieee_focus_on_computer_hardware.pdf

11.0 Examination Note

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The students declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

• There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.

• Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus.

• The average of the two tests shall be scaled down to 25 marks

• Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)

• The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

12.0 Course Delivery Plan

MODULE	LECTURE NO.	CONTENT OF LECTURE	% OF PORTION
1	1	Basics- vector analysis	20
	2	Coordinate systems: Cartesian	
	3	Cylindrical	
	4	Spherical	
	5	Examples	
	6	Relation between coordinate systems	
	7	Experimental law of Coulomb.	
	8	Electric field intensity.	
	9	Field of a line charge.	
	10	Field due to continuous surface charge distribution	
	11	Field due to continuous volume charge distribution	
	12	Electric flux density	40
2	13	Gauss' law, Divergence.	
	14	Maxwell's First equation	
	15	Vector operator **del** and divergence theorem.	
	16	Energy expended in moving a point charge in an electric field	
	17	Definition of potential difference and Potential,	
	18	The potential field of a point charge and system of charges	
	19	Current and current density.	
	20	Continuity of current	
	21	Examples	
3	22	Laplace's and Poisson's equations.	60
	23	Laplace's Equations	
	24	Uniqueness theorem	
	25	Examples of the solutions of Laplace's equations.	
	26	Biot-Savart law. Examples	
	27	Ampere's circuital law. Examples	
	28	Curl, Stokes' theorem. Examples	
	29	Magnetic flux and flux density. Examples	
	30	Scalar magnetic potentials. Examples	
4	31	Force on a moving charge and differential current element	80
	32	Force between differential current elements	
	33	Magnetization and permeability	
	34	Magnetic boundary conditions	
	35	Magnetic circuit and Examples	
	36	Potential energy and forces on magnetic materials	
	37	Examples	
	38	Examples	
5	39	Faraday's law &Examples	100
	40	Displacement current &Examples	
	41	Maxwell's equation in point form.	
	42	Maxwell's equation in Integral form.	
	43	Wave propagation in free space and dielectrics	

	44	Wave propagation in perfect dielectric	
	45	Wave propagation in free space and dielectrics	
	46	Propagation in good conductors. Examples	
	47	Poynting's theorem derivation	
	48	Wave power.	
	49	&Examples	
	50	Examples from question papers	

13.0 QUESTION BANK

MODULE -1

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1. State coulomb's law of force between any two point charges & state the units of force.
2. Define electric field intensity. Obtain an expression for the electric field intensity at a point which is at a distance of 'R' from a point Q.
3. State the units of electric field intensity E & explain the method of obtaining E at a point in Cartesian system, due to a point charge Q.
4. Obtain an expression for total electric field intensity at a point due to infinite number of point charges.
5. An empty metal paint can is placed on a marble table, the lid is removed, and both parts are discharged (honorably) by touching them to ground. An insulating nylon thread is glued to the center of the lid, and a penny, a nickel, and a dime are glued to the thread so that they are not touching each other. The penny is given a charge of +5 nC, and the nickel and dime are discharged. The assembly is lowered into the can so that the coins hang clear of all walls, and the lid is secured. The outside of the can is again touched momentarily to ground. The device is carefully disassembled with insulating gloves and tools. (a) What charges are found on each of the five metallic pieces? (b) If the penny had been given a charge of +5 nC, the dime a charge of -2 nC, and the nickel a charge of -1 nC, what would the final charge arrangement have been?
6. 2 A point charge of 12 nC is located at the origin. Four uniform line charges are located in the x = 0 plane as follows: 80 nC/m at y = -1 and -5 m, -50 nC/m at y ~ -2 and -4m. (a) Find D at P(O, -3,2). (b) How much electric flux crosses the plane y = -3, and in what direction? (c) How much electric flux leaves the surface of a sphere, 4m in radius, centered at qo, -3, O)?
7. The value of E at pep = 2, 4J = 40°, z = 3) is given as E = 100ap - 200a", + 300az. Vim. Determine the incremental work required to move a 20-J..lC charge a distance of 6 J..lm in the direction of: (a) ap; (b) a",; (c) az; (d) E; (e) G = 2ax - 3ay + 4az.
8. Let E = 400ax - 300ay + 500az V 1m in the neighborhood of point P(6, 2, -3). Find the incremental work done in moving a 4-C charge a distance of I mm in the direction specified by: (a) ax + ay + az; (b) -2ax + 3ay - az.
9. If E = 120ap V 1m, find the incremental amount of work done in moving a 50-J.. lC charge a distance of 2 mm from: (a) P(l, 2, 3) toward Q(2, 1,4); (b) Q(2, 1,4) toward P(I, 2, 3).
10. Find the amount of energy required to move a 6-C charge from the origin to P(3, 1, -1) in the field E = 2xax - 3y2ay + 4az Vim along the straight-line path x = -3z, y = x + 2z.

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MODULE -2

1. State and prove divergence theorem
2. Let D = 4xyax + 2(x^2+ z^2) ay+ 4yzaz C/m^2 and evaluate surface integrals to find the total charge enclosed in the rectangular parallelepiped 0 <x < 2, 0 <y < 3, 0 <z < 5m.
3. Two uniform line charges, each 20 nC/m, are located at y = I, z = ::!: I m. Find the total electric flux leaving the surface of a sphere having a radius of 2m, if it is centered at: (a) A(3, 1,0); (b) B(3, 2, 0).
4. Given the electric flux der.sity, D = 2xyax + x^2ay + 6z^3az Cjm^2: (a) use Gauss's law to evaluate the total charge enclosed in t.he volume 0 <x, y, z <a.
5. Determine work done in carrying a charge of 2C from B(1, 0,1) to A(08, 0.6, 0) in an electric field of E = yax + xay V/along the short arc of the circle x^2+ y^2=1, z =1; along a straight line path.
6. A 15nC point charge is at origin in free space. Calculate V1 if point P is located at P (-2, 3, -1) and I) V =0V at (6, 5, 4) ii) V =0V at infinity.
7. Discuss current, current density and hence derive an expression for continuity equation.
8. The z =0, defines the the boundary between free space and dielectric with dielectric constant 20. The E in free space is E = 10ax +20 ay + 40az V/m.

9. Derive an expression for electric potential due to a point charge.
10. Derive an expression for electric potential due to a infinite line charge.

MODULE -3

1. Explain Poisson's & Laplace's equations.
2. State & explain uniqueness theorem.
3. Given the potential field V = 4yz/ (x^2+ 1); Find V and ρat (1, 2, 3)
4. Use Laplace equation to find the capacitance per unit length of co-axial cable of inner radius a m and outer b m. Assume V = Vo at r=a and V=0 at r=b.
5. Determine whether or not the following vectors represent a possible electric field
   i) E = 5Cosz Az V/m
   ii) E = ($12yx^2$-$6z^2x$) ax + ($4x^3$+$18zy^2$) ay + ($6y^3$ −$6zx^2$) A_Z
6. Explain properties of magnetic field.
7. Derive an expression for H due to infinite long straight conductor.
8. Derive an expression for H due to finite long straight conductor.

MODULE -4

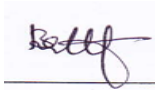
1. An infinite filament on the z axis carries 20n mA in the A_z direction. Three uniform cylindrical current sheets are also present: 400mAim at P = 1 cm, -250mA/m at P = 2cm, and -300mA/m at P = 3 em. Calculate Hq, at p = 0.5, 1.5,2.5, and 3.5 cm.
2. State and explain Magnetic flux & Magnetic density.
3. Derive an expression for force on a moving charge.
4. Derive an expression for force & torque on a closed circuit.
5. Explain the nature of magnetic materials.
6. What is Magnetization & Permeability? Derive an expression for magnetic boundary conditions.

MODEL-5

1. Wet marshy soil is characterized by σ = 10^{-2} s/m. εr = 15 and ur = 1. At frequencies 60Hz and 10GHz. Indicate whether soil be considered as a conductor or dielectric.
2. What is displacement current and equation of continuity? Derive Maxwell's equation for Ampere's circuital law.
3. Obtain the solution of wave equation for a uniform (UPW) in free space.
4. Discuss uniform plane wave propagation in a good conducting media.
5. State and prove Poynting theorem.
6. Derive an expression for depth of penetration
7. Find the depth of penetration at a frequency of 1.6MHz in aluminum, where σ = 38.2Ms/m and ur = 1. Also find γ , λ and Vp.
8. A 800MHz plane wave travelling has an average Poynting vector of 8mW/m2. I the medium is lossless with ur= 1.5 and εr = 6. Find i) Velocity of the wave ii) wave length iii) Impedance of the medium iv) r.m.s. Electric field E v) r.m.s magnetic field H.
9. For an electromagnetic wave propagating in free space prove that {IEI/IHI} = η

15.0 University Result

Examination	S+	S	A	B	C	D	E	% Passing
Aug 2024	65	54	22	29	03	11	01	83.07

Prepared by	Checked by		
			
Dr. B. I. Kattimani	**Prof. S. S. Kamate**	**HOD**	**Principal**

Subject Title	**PRINCIPLES OF COMMUNICATION SYSTEMS**		
Subject Code	BEC402	**IA Marks (15) +Assignments (10) + CIE Marks for Laboratory Component of IPCC (25)**	50
Number of Lecture Hrs/Week	03(L)	**Exam Marks (appearing for)**	50 (100)
Total Number of Lecture Hrs	40 Theory + 10 Lab Slots	**Exam Hours**	03
CREDITS – 03			

FACULTY DETAILS:		
Name: Dr. S. S. Ittannavar **Prof. K. S . Patil**	**Designation:** Associate Professor Asst. Professor	**Experience:**12 years 31 Years
No. of times course taught: 02 & 01	**Specialization:** Digital Signal Processing	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Students should have the knowledge of basic subjects	1 & 2	Basic Electronics

2.0 Course Objectives

This course will enable students to

• Understand and analyze concepts of Analog Modulation schemes viz; AM, FM.

• Design and analyze the electronic circuits for AM and FM modulation and demodulation.

• Understand the concepts of random variable and random process to model communication systems.

• Understand and analyze the concepts of digitization of signals.

• Evolve the concept of SNR in the presence of channel induced noise.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.

2. Show Video/animation films to explain evolution of communication technologies.

3. Encourage collaborative (Group) Learning in the class.

4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.

5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.

6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.

7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

3.0 Course Outcomes

Having successfully completed this course, the student will be able to

	Course Outcome	Cognitive Level	PO's
CO1	Understand the principles of analog communication systems and noise modelling.	U	1,2,3,4,6,7,9,10,11,12
CO2	Identify the schemes for analog modulation and	U	1,2,3,4,5,6,7,9,10,11,
CO3	Design of PCM systems through the processes sampling, quantization and encoding.	U	1,2,3,4,5,6,7,9,10,11, 12
CO4	Describe the ideal condition, practical considerations of the signal representation for baseband transmission of digital signals	U	1,2,3,4,5,6,7,9,10,11, 12
CO5	Identify and associate the random variables and random process in Communication system design.	U	1,2,3,4,5,6,7,9,10,11, 12
Total Hours of instruction		**40**	

4.0 Course Content

Modules	Teaching Hours	Bloom's Taxonomy (RBT) level
Module 1		
Random Variables and Processes: Introduction, Probability, Conditional Probability, Random variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross–correlation functions, Gaussian Process: Gaussian Distribution Function. **[Text 2: 5.1, 5.2,5.3,5.4,5.5,5.6,5.9]**	**08**	**L1, L2**
Module -2		
Amplitude Modulation Fundamentals: AM Concepts, Modulation index and Percentage of Modulation, Sidebands and the frequency domain, AM Power, Single Sideband Modulation. AM Circuits: Amplitude Modulators: Diode Modulator, Transistor Modulator, collector Modulator. Amplitude Demodulators: Diode Detector, Balanced Modulators: Lattice Modulators. Frequency Division Multiplexing: Transmitter-Multiplexer, Receiver-De-multiplexer. **[Text1: 3.1, 3.2,3.3,3.4,3.5,4.2,4.3,4.4,10.2]**	**08**	**L1, L2,L3**
Module-3		
Fundamentals of Frequency Modulation: Basic Principles of Frequency Modulation, Principles of Phase Modulation, Modulation index and sidebands, Noise Suppression Effects of FM, Frequency Modulation versus Amplitude Modulation. FM Circuits: Frequency Modulators: Voltage Controlled Oscillators, Frequency Demodulators: Slope Detectors, Phase Locked Loops. Communication Receiver: Super heterodyne receiver, Frequency Conversion: Mixing Principles, JFET Mixer. **[Text1: 5.1,5.2,5.3,5.4,5.5,6.1,6.3,9.2,9.3]**	**08**	**L1, L2,L3**

Module-4		
Digital Representation of Analog Signals: Introduction, Why Digitize Analog Sources? The Sampling process, Pulse Amplitude Modulation, Time-Division Multiplexing, Pulse Position Modulation: Generation and Detection of PPM wave. The Quantization Process. Pulse Code Modulation: Sampling, Quantization, Encoding, line Codes, Differential encoding, Regeneration, Decoding, filtering, multiplexing. **[Text2: 7.1,7.2,7.3,7.4,7.5,7.6,7.8,7.9]**	**08**	**L1, L2,L3**
Module-5		
Baseband Transmission of Digital signals: Introduction, Inter symbol Interference, Eye Pattern, Nyquist criterion for distortion-less Transmission, Baseband M-ary PAM Transmission. **[Text2:8.1,8.4,8.5,8.6,8.7]** Noise: Signal to Noise Ratio, External Noise, Internal Noise, Semiconductor Noise, Expressing Noise Levels, Noise in Cascade Stages. **[Text1:9.5]**	**08**	**L1, L2, L3**

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VIII	Project work	DSP, image processing and communication
02	V/VII	Digital communication, Multimedia Communication	Projects and Research

6.0 Relevance to Real World

SL. No	Real World Mapping
01	Analyze different signals in real time applications
02	Model creation for analysis

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	NPTEL	Principles of Communication Systems https://nptel.ac.in/courses/108104091
02	NPTEL	Communication Engineering https://nptel.ac.in/courses/117102059

8.0 Books Used and Recommended to Students

Text Books
1. Louis E Frenzel, Principles of Electronic Communication Systems, 3rd Edition, Mc Graw Hill Education (India) Private Limited, 2016. ISBN: 978-0-07-066755-6. 2. Simon Haykin & Michael Moher, Communication Systems, 5th Edition, John Wiley, India Pvt. Ltd, 2010, ISBN: 978-81-265-2151-7.
Reference Books
1. B P Lathi, Zhi Ding, "Modern Digital and Analog Communication Systems", Oxford University Press., 4th edition, 2010, ISBN: 97801980738002. 2. Herbert Taub, Donald L Schilling, Goutam Saha, "Principles of Communication systems", 4th Edition, Mc Graw Hill Education (India) Private Limited, 2016. ISBN: 978-1-25-902985-1.

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References
04) **https://nptel.ac.in/courses/108104091**
05) https://nptel.ac.in/courses/117102059

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	IEEE Explorer	https://www.journals.elsevier.com/digital-signal-processing
2	International Journal of Science and Technology	https://signalprocessingsociety.org/
3	PC World	http://www.imanagerpublications.com/JournalIntroduction.aspx?journal=JournalonDigitalSignalProcessing

11.0 Examination Note

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

The IPCC means the practical portion integrated with the theory of the course. CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.

CIE for the theory component of the IPCC

• 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and 10 marks for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.

• Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for 25 marks).

• The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

• 15 marks for the conduction of the experiment and preparation of laboratory record, and 10 marks for the test to be conducted after the completion of all the laboratory sessions.

• On completion of every experiment/program in the laboratory, the students shall be evaluated including viva voce and marks shall be awarded on the same day.

• The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write ups are added and scaled down to 15 marks.

• The laboratory test (duration 02/03 hours) after completion of all the experiments shall be conducted for 50 marks and scaled down to 10 marks. • Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 25 marks.

• The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course **(duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

• The minimum marks to be secured in CIE to appear for SEE shall be 10 (40% of maximum marks-25) in the theory component and 10 (40% of maximum marks -25) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 sub-questions are to be set from the practical component of IPCC, the total marks of all questions should not be more than 20 marks.

• SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify for the SEE. Marks secured will be scaled down to 50.

• The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

12.0 Course Delivery Plan

Module No.	Lecture No.	Content of Lecture	Teaching Method	% of Portion
1.	1	Random Variables and Processes: Introduction	Chalk and talk	20
	2	Probability, Conditional Probability, Random variables.	Chalk and talk	
	3	Statistical Averages: Function of a random variable.	Chalk and talk	
	4	Moments, Random Processes, Mean	Chalk and talk	
	5	Correlation and Covariance function: Properties of autocorrelation function.	Chalk and talk	
	6	Cross–correlation functions, Gaussian Process	Chalk and talk	
	7	Gaussian Distribution Function	Chalk and talk	
	8	Problems	Chalk and talk	
2.	9	Amplitude Modulation Fundamentals: AM Concepts.	Chalk and talk	20
	10	Modulation index and Percentage of Modulation, Sidebands and the frequency domain.	Chalk and talk	
	11	AM Power, Single Sideband Modulation.	Chalk and talk	
	12	AM Circuits: Amplitude Modulators	Chalk and talk	
	13	Diode Modulator, Transistor Modulator	Chalk and talk	
	14	collector Modulator. Amplitude Demodulators:	Chalk and talk	
	15	Frequency Division Multiplexing	Chalk and talk	
	16	Transmitter-Multiplexer, Receiver-Demultiplexer.	Chalk and talk	
3.	17	Fundamentals of Frequency Modulation: Basic Principles of Frequency Modulation.	Chalk and talk	20
	18	Principles of Phase Modulation.	Chalk and talk	
	19	Modulation index and sidebands, Noise Suppression Effects of FM.	Chalk and talk	
	20	Frequency Modulation versus Amplitude Modulation.	Chalk and talk	
	21	FM Circuits: Frequency Modulators: Voltage Controlled Oscillators.	Chalk and talk	
	22	Frequency Demodulators: Slope Detectors, Phase Locked Loops.	Chalk and talk	
	23	Communication Receiver: Super heterodyne receiver	Chalk and talk	
	24	Frequency Conversion: Mixing Principles, JFET Mixer.	Chalk and talk	
4.	25	Digital Representation of Analog Signals: Introduction, Why Digitize Analog Sources?	Chalk and talk	20
	26	The Sampling process, Pulse Amplitude Modulation.	Chalk and talk	
	27	Time-Division Multiplexing.	Chalk and talk	
	28	Pulse Position Modulation: Generation and Detection of PPM wave.	Chalk and talk	
	29	The Quantization Process. Pulse Code Modulation.	Chalk and talk	
	30	Sampling, Quantization, Encoding.	Chalk and talk	
	31	Line Codes, Differential encoding.	Chalk and talk	
	32	Regeneration, Decoding, filtering, multiplexing.	Chalk and talk	

5.	33	Baseband Transmission of Digital signals: Introduction	Chalk and talk	20
	34	Inter symbol Interference, Eye Pattern	Chalk and talk	
	35	Nyquist criterion for distortion less Transmission.	Chalk and talk	
	36	Baseband M-ary PAM Transmission.	Chalk and talk	
	37	Noise: Signal to Noise Ratio, External Noise	Chalk and talk	
	38	Internal Noise, Semiconductor Noise	Chalk and talk	
	39	Expressing Noise Levels	Chalk and talk	
	40	Noise in Cascade Stages	Chalk and talk	

13.0 Assignments, Pop Quiz, Mini Project, Seminars

Sl.No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: University Questions on Random Process, Amplitude Modulation and Frequency Modulation.	Students study the Topics and will prepare for Final Exam.	Module-1, 2 & 3 of the syllabus	9	Individual Activity	Text Book 1&2
2	Assignment 2: University Questions on Digital representation of analog signals and base band transmission of Digital signals.	Students study the Topics and will prepare for Final Exam.	Module-3,4 & 5 of the syllabus	12	Individual Activity.	Text Book 1& Text Book 2

14.0 University Result

Examination	No of Students appeared	No of Students passed	FCD	FC	SC	Fail	AB	% of passing
First Time Introduced	66	65	54	5	6	1	1	98.48%

15.0 QUESTION BANK

1. Define standard form of amplitude modulation, derive its equation and explain each term. Derive the Spectral equation of AM wave and hence draw and explain the AM spectrum.
2. Explain the generation of DSBSC waves using a Ring Modulator.
3. A 1000 KHz carrier is simultaneously modulated to 300 Hz, 800Hz and 2KHz audio Sinewaves. What will be the frequency content of AM signal.
4. Explain the scheme of generation and demodulation of VSB modulated wave with relevant spectrum of signals and mathematical expressions
5. Consider a two-stage product modulator with a BPF after each product modulator, where the input signal consists of a voice signal occupying the frequency band 0.3 to 3.4 kHz. The two local oscillator frequencies have the value $f1$ = 100 kHz and $f2$ = 10 MHz. Calculate the following : i. Sidebands of DSBSC modulated waves appearing at the two product modulator outputs. ii. Sidebands of SSB modulated waves appearing at the BPF outputs. iii) The pass-

bands of the two BPF‟s.

6. With a neat block diagram , explain the working of a FDM transmitter and receiver
7. Derive the expression for WBFM, Show that the spectrum of WBFM wave contains infinite number of sidebands. Write the expression of theoretical bandwidth for WBFM
8. Determine the bandwidth of an FM signal, if the maximum value of the frequency deviation Δf is fixed at 75kHz for commercial FM broadcasting by radio and modulation frequency is W= 15 kHz. I i) Bycarson‟s rule ii) By universal curve given BT /Δf=3.2 for β=5 5 OR With neat diagram explain crystal oscillator.
9. With relevant equations and diagram explain the direct method generation FM using Hartley Oscillator.
10. Write the basic block diagram of PLL? Derive the expression for nonlinear model of PLL.
11. With a neat block diagram explain the operation of a Super- heterodyne receiver.
12. Derive the expression for Figure of Merit of a frequency modulated receiver.
13. Define noise. What is Noise Equivalent Bandwidth? Explain with relevant equations.
14. Using expression for figure of merit of AM , find the FOM of single tone AM
15. With DSBSC receiver model derive the expression for figure of merit.
16. Briefly explain the following as applicable to FM (i) Capture effect (ii)Threshold effect. (iii) Pre-emphasis (iv) De-emphasis
17. Write a short notes on a) Thermal noise b) Shot noise
18. State Sampling theorem and explain the same with neat sketches and equations.
19. What is the necessity of Digitizing of the analog signals?
20. With neat Block diagrams explain the generation and detection of PPM waves.
21. Explain the generation and recovery of PAM (Flat-top) signal with necessary equations and spectrum diagram.
22. With a neat block diagram outline the concept of TDM.
23. Describe the effect of Noise on a Pulse position modulation System.
24. Derive the expression for the output Signal to Noise Ratio of a Quantizer
25. With a neat diagram explain the basic elements of a PCM system.
26. A compact disc (CD) records audio signals digitally using PCM. Assume the audio signal bandwidth to be 15 KHz.
    a. What is the Nyquist rate?
    b. If the Nyquist samples are quantized to L = 65, 536 levels and then binary coded, determine the number of bits required to encode a sample.
    c. Assuming that the signal is sinusoidal and that the maximum signal amplitude is 1 volt; determine the quantization step and the signal-to-quantization noise ratio.
27. Write a note on Vocoders.
28. What are the desirable properties of digital waveforms? To transmit a bit sequence 10011011, draw the resulting waveforms using:- Unipolar NRZ; polar NRZ; Unipolar RZ ; Bipolar RZ ; Manchester(split phase)
29. A TV signal with a bandwidth of 4.2 MHz is transmitted using binary PCM. The number of representation level is 512. Calculate: i) Code word length ii) Final bit rate iii) Transmission bandwidth**.**

Prepared by	Checked by		
			
Dr. S. S. Ittannavar	**Prof. D. M. Kumbhar**	**HOD**	**Principal**

Subject Title	**PRINCIPLES OF COMMUNICATION SYSTEMS LAB**		
Subject Code	BEC402	**Conduction of experiments (15)+ Laboratory Test (10)**	25
Number of Lecture Hrs/Week	2(P)	**Exam Marks**	25
Total Number of Lecture Hrs	10 Lab Slots	**Test Hours**	03
CREDITS – 02			
FACULTY DETAILS:			
Name:1. Dr. S. S. Ittannavar	**Designation: 1.** Associate Professor	**Experience:1.** 12 years	
No. of times course taught: 02 & 01	**Specialization:** Digital Signal Processing		

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Students should have the knowledge of basic subjects	3	Basic Electronics

2.0 Course Objectives

This course will enable students to

- Understand and analyze concepts of Analog Modulation schemes viz; AM, FM.
- Design and analyze the electronic circuits for AM and FM modulation and demodulation.
- Understand the concepts of random variable and random process to model communication systems.
- Understand and analyze the concepts of digitization of signals.
- Evolve the concept of SNR in the presence of channel induced noise.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain evolution of communication technologies.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

3.0 Course Outcomes

Having successfully completed this course, the student will be able to

	Course Outcome	Cognitive Level	PO's
CO1	Understand the principles of analog communication systems and noise modelling.	U	1,2,3,4,6,7,9,10,11,12
CO2	Identify the schemes for analog modulation and demodulation and compare their performance.	U	1,2,3,4,5,6,7,9,10,11,12
CO3	Design of PCM systems through the processes sampling, quantization and encoding.	U	1,2,3,4,5,6,7,9,10,11,12
CO4	Describe the ideal condition, practical considerations of the signal representation for baseband transmission of digital signals.	U	1,2,3,4,5,6,7,9,10,11,12
CO5	Identify and associate the random variables and random process in Communication system design.	U	1,2,3,4,5,6,7,9,10,11,12
Total Hours of instruction		**20**	

4.0 Course Content

Practical Component of IPCC		
Experiments	**Teaching Hours**	**Bloom's Taxonomy (RBT) level**
1. Basic Signals and Signal Graphing: a) unit Step, b) Rectangular, c) standard triangle d) sinusoidal and e) Exponential signal.	02	L3
2. Illustration of signal representation in time and frequency domains for a rectangular pulse.	02	L3
3. Amplitude Modulation and demodulation: Generation and display the relevant signals and its spectrums.	02	L3
4. Frequency Modulation and demodulation: Generation and display the relevant signals and its spectrums.	02	L3
5. Sampling and reconstruction of low pass signals. Display the signals and its spectrum.	02	L3
6. Time Division Multiplexing and demultiplexing.	02	L3
7. PCM Illustration: Sampling, Quantization and Encoding.	02	L3
8. Generate a)NRZ, RZ and Raised cosine pulse, b) Generate and plot eye diagram	02	L3
9. Generate the Probability density function of Gaussian distribution function.	02	L3
10. Display the signal and its spectrum of an audio signal.	02	L3

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VI	Mini Project	DSP
02	VIII	Project Work	DSP based projects

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Analyze different signals in real time applications
02	Model creation for analysis

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Solving different types of programs

8.0 Books Used and Recommended to Students

1. Lab Manual

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References
1. **https://nptel.ac.in/courses/108104091**
2. https://nptel.ac.in/courses/117102059

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	IEEE Explorer	https://www.journals.elsevier.com/digital-signal-processing
2	International Journal of Science and Technology	https://signalprocessingsociety.org/
3	Journal of Communication Engineering	http://www.imanagerpublications.com/JournalIntroduction.aspx?journal=JournalonDigitalSignalProcessing

11.0 Examination Note

CIE for the practical component of the IPCC

• 15 marks for the conduction of the experiment and preparation of laboratory record, and 10 marks for the test to be conducted after the completion of all the laboratory sessions.

• On completion of every experiment/program in the laboratory, the students shall be evaluated including viva voce and marks shall be awarded on the same day.

• The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write ups are added and scaled down to 15 marks.

• The laboratory test (duration 02/03 hours) after completion of all the experiments shall be conducted for 50 marks and scaled down to 10 marks. • Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 25 marks.

• The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

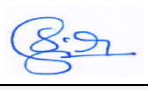
12.0 Course Delivery Plan

Experiments	% of portion
1. Basic Signals and Signal Graphing: a) unit Step, b) Rectangular, c) standard triangle d) sinusoidal and e) Exponential signal.	10
2. Illustration of signal representation in time and frequency domains for a rectangular pulse.	10
3. Amplitude Modulation and demodulation: Generation and display the relevant signals and its spectrums.	10
4. Frequency Modulation and demodulation: Generation and display the relevant signals and its spectrums.	10
5. Sampling and reconstruction of low pass signals. Display the signals and its spectrum.	10
6. Time Division Multiplexing and demultiplexing.	10
7. PCM Illustration: Sampling, Quantization and Encoding.	10
8. Generate a)NRZ, RZ and Raised cosine pulse, b) Generate and plot eye diagram	10
9. Generate the Probability density function of Gaussian distribution function.	10
10. Display the signal and its spectrum of an audio signal.	10

13.0 University Result

Examination	S+	S	A	B	C	D	E	% of passing
First Time Introduced	-	-	-	-	-	-	-	-

14.0 VIVA QUESTIONS

Prepared by	Checked by		
			
Dr. S. S. Ittannavar	**Prof. D. M. Kumbhar**	**HOD**	**Principal**

Subject Title	**Control systems**		
Subject Code	**BEC403**	**IA Marks 15 +Assignments GD/Quiz/Seminar10 + Lab 15 +10**	50(100)
Number of Lecture Hrs/Week	03 + 02	**Exam Marks (appearing for)**	50 (100)
Total Number of Lecture Hrs	40+12 Lab	**Exam Hours**	03
CREDITS – 04			

FACULTY DETAILS:		
Name: Prof. D. M. Kumbhar	**Designation:** Asst. Professor	**Experience:** 17.6 years (Industry 7years)
No. of times course taught: 02	**Specialization:** Digital Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Electronics and communication Engineering	III	Network analysis
02	Electronics and communication Engineering	I	Elements of Mechanical Engineering

2.0 Course Objectives

1. Understand basics of control systems and design mathematical models using block diagram reduction, SFG, etc.
2. Understand Time domain and Frequency domain analysis.
3. Analyze the stability of a system from the transfer function
4. Familiarize with the State Space Model of the system.

3.0 Course Outcomes

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

	Course Outcome	RBT Level	POs
C218.1	Deduce transfer function of a given physical system, from differential equation representation or Block Diagram representation and SFG representation.	L1,L2,L3	1,2,3,4,5,12
C218.2	Calculate time response specifications and analyze the stability of the system.	L1,L2,L3	1,2,3,4,5,12
C218.3	Draw and analyze the effect of gain on system behavior using root loci.	L1,L2,L3	1,2,3,4,5,12
C218.4	Perform frequency response Analysis and find the stability of the system. Root-locus technique.	L1,L2,L3	1,2,3,4,5,12
C218.5	Represent State model of the system and find the time response of the system.	L1,L2,L3	1,2,3,4,5,12
Total Hours of instruction		**50**	

4.0 Course Content

Module 1	Teaching Hours	Bloom's Taxonomy (RBT) level
Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems –Mechanical Systems, Electrical Systems, Electromechanical systems, Analogous Systems	**08**	**L1,L2,L3**
Module -2 **Block diagrams and signal flow graphs:** Transfer functions, Block diagram algebra and Signal Flow graphs.	**08**	**L1,L2,L3**
Module-3 **Time Response of feedback control systems:** Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design).	**08**	**L1,L2,L3**
Module-4 **Stability analysis:** Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion. Introduction to Root-Locus Techniques, The root locus concepts, Construction of root loci.	**08**	**L1,L2,L3**
Module-5 **Frequency domain analysis and stability:** Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function. Mathematical preliminaries, Nyquist Stability criterion. (Stability criteria related to polar plots are excluded) **State Variable Analysis:** Introduction to state variable analysis: Concepts of state, state variable and state models. State model for Linear continuous –Time systems, solution of state equations.	**08**	**L1,L2,L3**

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VIII	Project work	Various process control systems.
02	IV	Microcontrollers.	Motor controllers
03	VI	Digital Communication	Sampling process & Signal reconstruction

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Industrial drawings and design of various components
02	Model creation for analysis
03	Development of a mathematical models through software applications

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: control systems and types of control system.
02	NPTEL	Assembly Application

8.0 Books Used and Recommended to Students

Text Books
1 J. Nagarath and M.Gopal, "Control Systems Engineering", New Age International (P) Limited, Publishers, Fourth edition – 2005,ISBN:81-224-2008-7
Reference Books
1. "Modern Control Engineering ", K. Ogata, Pearson Education Asia/ PHI, 4th Edition, 2002. 2. "Automatic Control Systems", Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008. 3. "Feedback and Control System", Joseph J Distefano III et al., Schaum's Outlines, TMH, 2nd Edition 2007.
Additional Study material & e-Books
1. Control systems: Ganesh Rao
2. A.P.Godse & U.A.Bakshi, "control systems", Technical Publications
3. Control systems by A.K.Jairath

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References
1) https://hareeshang.wordpress.com/tutorials/camd/
2) http://m.noteboy.in/vtuflies/machine%20drawing.pdf
3) https://www.edx.org/school/iitbombayx?utm_source=bing&utm_medium=cpc&utm_term=iit-bombay&utm_campaign=partner-iit-bombay
4) http://www.vlab.co.in/

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	Journal of Aircraft	http://arc.aiaa.org/loi/ja
2	International Journal of Solids and Structures	http://www.sciencedirect.com/science/journal/00207683
3	Journal of Manufacturing Science and Engineering	http://manufacturingscience.asmedigitalcollection.asme.org/issue.aspx?journalid=125&issueid=27340
4	American Fastener Journal	http://www.fastenerjournal.com/

11.0 Examination Note

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of 20 Marks (duration 01 hour)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of 10 Marks

• First assignment at the end of 4th week of the semester

• Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for 30 marks.

CIE for the practical component of IPCC

• On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The 15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.

• The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

• The laboratory test (duration 03 hours) at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks.

• Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 20 marks.

SEE for IPCC Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

• The question paper will have ten questions. Each question is set for 20 marks.

• There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

• The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component.

• The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks. SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured out of 100 shall be reduced proportionally to 50.

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
1	1	Types of Control Systems, Effect of Feedback Systems,	20
	2	Differential equation of Physical Systems –Mechanical Systems,	
	3	Differential equation of Physical Systems –Mechanical Systems,	
	4	Differential equation of Physical Systems –Electrical Systems,	
	5	Differential equation of Physical Systems –Electrical Systems,	
	6	Electromechanical systems, Analogous Systems	
	7	Electromechanical systems, Analogous Systems	
	8	Electromechanical systems, Analogous Systems	
2	9	Transfer functions, Block diagram algebra and Signal Flow graphs.	40
	10	Transfer functions, Block diagram algebra and Signal Flow graphs.	
	11	Transfer functions,	
	12	Transfer functions,	
	13	Block diagram algebra	
	14	Block diagram algebra	
	15	Signal Flow graphs.	
	16	Signal Flow graphs.	
3	17	Standard test signals, Unit step response of First and Second order Systems.	60
	18	Standard test signals, Unit step response of First and Second order Systems.	
	19	Time response specifications, Time response specifications of second order systems	
	20	response specifications of second order systems,	
	21	steady state errors and error constants.	
	22	steady state errors and error constants.	
	23	Introduction to PI, PD and PID Controllers	
	24	Introduction to PI, PD and PID Controllers	
4	25	Concepts of stability	80
	26	Necessary conditions for Stability	
	27	Routh stability criterion	
	28	Relative stability analysis	
	29	More on the Routh stability criterion.	
	30	Introduction to Root-Locus Techniques	
	31	The root locus concepts	
	32	Construction of root loci.	100
5	33	Correlation between time and frequency response,	
	34	Bode Plots, Experimental determination of transfer function.	
	35	Mathematical preliminaries, Nyquist Stability criterion,	
	36	Introduction to lead, lag and lead- lag compensating networks (excluding design).	
	37	Concepts of state, state variable and state models for electrical systems	
	38	State variable and state models for electrical systems, Solution of state equations.	
	39	State variable and state models for electrical systems, Solution of state equations.	
	40	Solution of state equations.	

PRACTICAL COMPONENT OF IPCC :
Using suitable simulation software (P-Spice/ MATLAB / Python / Scilab / OCTAVE / LabVIEW) demonstrate the operation of the following circuits:

Sl.No.	Experiments
1	Implement Block diagram reduction technique to obtain transfer function a control system.
2	Implement Signal Flow graph to obtain transfer function a control system.
3	3 Simulation of poles and zeros of a transfer function.
4	Implement time response specification of a second order Under damped System, for different damping factors.
5	Implement frequency response of a second order System.
6	Implement frequency response of a lead lag compensator.
7	Analyze the stability of the given system using Routh stability criterion.
8	Analyze the stability of the given system using Root locus.
9	Analyze the stability of the given system using Bode plots.
10	Analyze the stability of the given system using Nyquist plot.
11	Obtain the time response from state model of a system.
12	Implement PI and PD Controllers.
13	Implement a PID Controller and hence realize an Error Detector.
14	Demonstrate the effect of PI, PD and PID controller on the system response.

13.0 University Result

Examination	FCD	FC	SC	% Passing
July202426	26	12	19	87.69

14.0 QUESTION BANK

Q1. Explain different types of control systems.

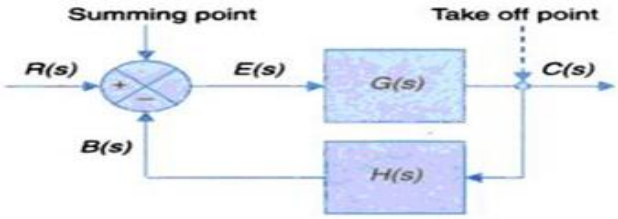
Q2. Define open loop and closed loop systems and differentiate between them with a example.

Q3. What is feedback? Explain effect of feedback systems.

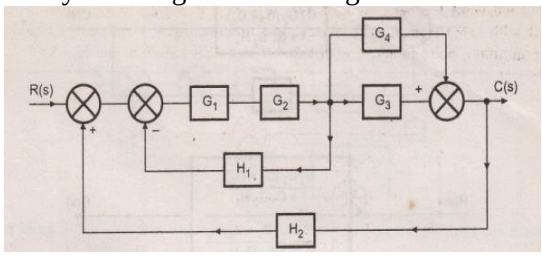
Q4. Distinguish between open loop and closed loop systems.

Q5. Write the differential equation for electrical Physical system.

Q6. For the block diagram shown find the closed loop transfer function.

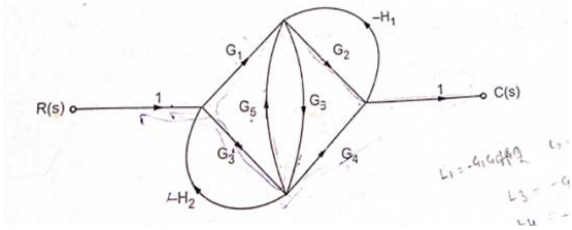


Q7. Find the transfer function by reducing the block diagram shown in fig.

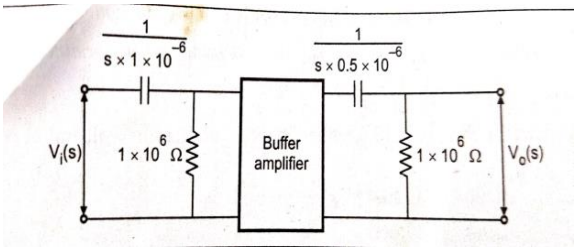


Q8. Define Mason's gain formulain as related to Signal flow Graph.

Q9.Find the transfer function by Mason's Gain formula for the Signal flow Graph shown in Fig



Q10. Find the transfer function for the system shown with unity gain buffer amplifier shown in Fig



Q11. Derive an expression for C(t) of an under damped second order system for a unit step input.

Q12. Obtain expressions for specifications namely time constant, rise time, and settling time of first order system for a unit step input.

Q13. A unity feedback system is characterized by an open loop transfer function

$$G(S) = \frac{K}{S(S+10)}$$

find the value of K so that the system will have the damping ratio of 0.5. for this value of K find MP, tS
for a unit step input.

Q14. Starting from the output equation C(t) derive expressions for:
Peak time (tp) (ii) Peak overshoot (Mp)of an under damped second order system subjected to unit step input.

Q15. Derive the step input response of a first order system.

Q16. Define stability and hence stable, unstable, marginally stable, and conditional stability of a unity feedback
system.

Q17. Explain Routh – Hurwitz criterion for stability of the system and what are its limitations.

Q18. Find the range of K so that system with characteristic equation as: S4 + 22 S3 + 10 S2 + S + K =0 is stable. Also find frequency of oscillation at marginal value of K.

Q19. Find the number of roots of this equation with +ve real parts, zero real part and –ve real part for the
equation S6+4S5+3S4-16S2-64S-48=0.

Q20. Draw the approximate root locus diagram for closed loop system whose loop Transfer

$$G(S)H(S) = \frac{K}{S(S+5)(S+10)}$$

Comment on the stability

Q21. For a closed loop control system determine resonant peak and resonant frequency

$$G(s) = \frac{100}{s(s+8)} \quad H(s) = 1$$

.

Q22.Define state, state variable, state space.

Q23. Construct the state model using phase variables if the system is described by the diff equation, Draw the state diagram.

$$\frac{d^3y(t)}{dt^3} + \frac{4d^2y(t)}{dt^2} + 7\frac{dy(t)}{dt} + 2y(t) = 5U(t)$$

Prepared by	Checked by		
Prof. D. M. Kumbhar	Prof. S. S. Malaj	HOD	Principal

Subject Code	BECL404 (Communication Lab)	**CIE Marks for Laboratory Component of PCCL(50)**	50
Number of	02(P)	**Exam Marks**	50
Total Number of Practical Hrs.	12 Lab Slots	**Exam Hours**	03
CREDITS – 01			

FACULTY DETAILS:		
Name: Dr. B. I. Kattimani **Prof. K. S. Patil**	**Designation:** Associate Professor Asst. Professor	**Experience:**16years 31 Years
No. of times course taught:00	**Specialization: E&C**	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Students should have the knowledge of basic subjects	1 & 2	Basic Electronics

2.0 Course Objectives

This laboratory courses enables students to

• Understand the basic concepts of AM and FM modulation and demodulation.

• Design and analyze the electronic circuits used for AM and FM modulation and demodulation circuits. • Understand the sampling theory and design circuits which enable sampling and reconstruction of analog signals.

• Design electronic circuits to perform pulse amplitude modulation, pulse position modulation and pulse width modulation.

3.0 Course Outcomes

Course outcomes (Course Skill Set): At the end of the course the student will be able to:

	Course Outcome	RBT Level	POs
C219.1	Illustrate the AM generation and detection using suitable electronic circuits.	L4	1 to12
C219.2	Design of FM circuits for modulation, demodulation and noise suppression.	L4	1 to 12
C219.3	Design and test the sampling, Multiplexing and pulse modulation techniques using electronic hardware.	L4	1 to 12
C219.4	Design and Demonstrate the electronic circuits used for RF transmitters and receivers.	L4	1 to 12
Total Hours of instruction		**50**	

4.0 Course Content

Practical Component of IPCC		
Experiments	**Teaching Hours**	**Bloom's Taxonomy (RBT) level**
11. Design and test a high-level collector Modulator circuit and Demodulation the signal using diode detector.	02	L3
12. Test the Balanced Modulator / Lattice Modulator (Diode ring)	02	L3
13. Design a Frequency modulator using VCO and FM demodulator using PLL (Use IC566 and IC565).	02	L3
14. Design and plot the frequency response of Pre emphasis and De-emphasis Circuits	02	L3
15. Design and test BJT/FET Mixer	02	L3
16. Design and test Pulse sampling, flat top sampling and reconstruction	02	L3
17. Design and test Pulse amplitude modulation and demodulation.	02	L3
18. Generation and Detection of Pulse position Modulation	02	L3
19. Generation and Detection of Pulse Width Modulation	02	L3
20. PLL Frequency Synthesizer	02	L3
21. Data formatting and Line Code Generation	02	L3
22. PCM Multiplexer and De multiplexer	02	L3

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VI	Mini Project	IOT Based Projects
02	VIII	Project Work	Communication Based Projects

6.0 Relevance to Real World

SL.No	Real World Mapping
01	Analyze different signals in modulation & demodulation
02	Model creation for analysis

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic:

8.0 Books Used and Recommended to Students

01	Lab Manual
02	Principles of Electronic Communication System By louis E.Frenzel

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References
3. https://people.iitism.ac.in/~download/lab%20manuals/ece/7.%20ECC305%20Communication%20System%20Lab.pdf 4. https://people.iitism.ac.in/~download/lab%20manuals/ece/8.%20ECC308%20Digital%20Communication%20Lab.pdf

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	IEEE Explorer	https://www.journals.elsevier.com/digital-signal-processing
2	International Journal of Science and Technology	https://signalprocessingsociety.org/
3	Journal of Communication Engineering	http://www.imanagerpublications.com/JournalIntroduction.aspx?journal=JournalonDigitalSignalProcessing

11.0 Examination Note

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are 50 Marks. The split-up of CIE marks for record/ journal and test are in the ratio 60:40.

• Each experiment is to be evaluated for conduction with an observation sheet and record write-

up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to studentsat the beginning of the practical session.

• Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.

• Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).

• Weightage to be given for neatness and submission of record/write-up on time.

• Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.

• In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.

• The suitable rubrics can be designed to evaluate each student's performance and learning ability.

• The marks scored shall be scaled down to 20 marks (40% of the maximum marks). The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

• SEE marks for the practical course are 50 Marks.

• SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.

• The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.

• All laboratory experiments are to be included for practical examination.

• (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script
to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.

• Students can pick one question (experiment) from the questions lot prepared by the examiners
jointly.

• Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

• General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

• Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 02 hours.

12.0 Course Delivery Plan

Experiments	% of portion
1. Design and test a high-level collector Modulator circuit and Demodulation the signal using diode detector.	8
2. Test the Balanced Modulator / Lattice Modulator (Diode ring)	16
3. Design a Frequency modulator using VCO and FM demodulator using PLL (Use IC566 and IC565	25
4. Design and plot the frequency response of Pre emphasis and De-emphasis Circuits	33
5. Design and test BJT/FET Mixer	42
6. Design and test Pulse sampling, flat top sampling and reconstruction	50
7. Design and test Pulse amplitude modulation and demodulation.	58
8. Generation and Detection of Pulse position Modulation	67
9. Generation and Detection of Pulse Width Modulation	75
10. PLL Frequency Synthesizer	83
11. Data formatting and Line Code Generation	92
12. PCM Multiplexer and DE multiplexer	100

13.0 University Result

Examination	S+	S	A	B	C	D	E	F	% of passing
August 2024	65	65	65	00	00	00	00	01	100

14.0 VIVAQUESTIONS

1. Define Transmitter
2. Define Receiver
3. Define Attenuation
4. What is noise?
5. Mention the classification of Modulation
6. What is Decibels?
7. Explain Half Duplex
8. Explain Simplex
9. Explain Full duplex
10. Explain Pin diagram of IC 565
11. Explain Phase Detector & De Modulation
12. Define Modulation Index
13. Mention the applications of IC 565
14. Define amplitude Modulator
15. Explain over modulation
16. What is distortion?
17. What is biasing circuit?
18. What is FM?
19. What is FSK, PSK?

20. Mention the Types of Modulation.
21. Explain PIN –out Diagram of IC 741
22. What is IC LF 398?
23. Explain pin-out diagram 398. Justify.
24. What do you mean by A to D?
25. What is sampling process.?
26. State Sampling Theorem
27. What is Quantization process?
28. Define Aliasing effect
29. What is PLL?
30. Explain block diagram of PLL
31. What is PLL IC No?
32. What is Multiplexer?
33. What is the Nyquist rate
34. What is DE multiplexer?
35. What do you mean by Data formatting
36. What is line code generation?
37. Give the memory signal and memory less signal
38. What is low pass filter. Mention the types
39. Give the 1st order,2nd order system
40. State sampling theorem? What is the necessary condition?

13.0 University Result

Examination	No. of students appeared	No. of students passed	% Passing
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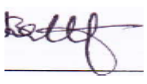			
Dr. B. I. Kattimani	**Prof. D. M. Kumbhar**	**HOD**	**Principal**

Subject Title	**OPERATING SYSTEMS**		
Subject Code	**BEC405C**	**CIE Marks**	50
Number of Lecture Hrs / Total Number of Lecture	03 40	**SEE Marks** **Exam Hours**	50 03

FACULTY DETAILS:		
Name: Prof. P.V.PATIL	**Designation:** Asst. Professor	**Experience:** 12.06Yrs
No. of times course taught:6	**Specialization:** VLSI Design &Embedded Systems	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	ECE	I/II	Basic Electronics, C programming
02	ECE	III	Digital Electronics
03	ECE	III	*Computer Organization* **&** *Architecture*

2.0 Course Objectives

This course will enable students to:

- Understand the services provided by an operating system.
- Explain how processes are synchronized and scheduled.
- Understand different approaches of memory management and virtual memory management.
- Describe the structure and organization of the file system
- Understand inter process communication and deadlock situations.

3.0 Course Outcomes

Having successfully completed this course, the student will be able to draw and analyze.

	Course Outcome	RBT Level	POs
C214.1	Explain the goals, structure, operation and types of operating systems.	L1, L2	PO1-PO4, PO6, PO07, PO11, P12
C214.2	Apply scheduling techniques to find performance factors.	L1, L2, L3	PO1-PO4, PO6, PO07, PO11, P12
C214.3	Explain organization of file systems and IOCS.	L1, L2	PO1-PO4, PO6, PO07, PO11, P12
C214.4	Apply suitable techniques for contiguous and non-contiguous memory allocation.	L1, L2, L3	PO1-PO4, PO6, PO07, PO11, P12
C214.5	Describe message passing, deadlock detection and prevention methods.	L1, L2	PO1-PO4, PO6, PO07, PO11, P12
Total Hours of instruction		**40**	

4.0 Course Content

Module-1	RBT Level
Introduction to Operating Systems OS, Goals of an OS, Operation of an OS, Computational Structures, Resource allocation techniques, Efficiency, System Performance and User Convenience, Classes operating System, Batch processing, Multi programming, Time Sharing Systems, Real Time and distributed Operating Systems(Topics from Sections 1.2, 1.3, 2.2 to 2.8 of Text). **8 Hours**	L1, L2
Module-2	
Process Management: OS View of Processes, PCB, Fundamental State Transitions of a process, Threads, Kernel and User level Threads, Non-preemptive scheduling- FCFS and SRN, Preemptive Scheduling- RR and LCN, Scheduling in Unix and Scheduling in Linux (Topics from Sections 3.3, 3.3.1 to 3.3.4, 3.4, 3.4.1, 3.4.2 , Selected scheduling topics from 4.2 and 4.3 , 4.6, 4.7 of Text). **8 Hours**	L1, L2, L3
Module-3	
Memory Management: Contiguous Memory allocation, Non-Contiguos Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, VM handler, FIFO, LRU page replacement policies, Virtual memory in Unix and Linux(Topics from Sections 5.5 to 5.9, 6.1 to 6.3 except Optimal policy and 6.3.1, 6.7,6.8 of Text). **8 Hours**	L1, L2, L3
Module-4	
File Systems: File systems and IOCS, File Operations, File Organizations, Directory structures, File Protection, Interface between File system and IOCS, Allocation of disk space, Implementing file access (Topics from Sections 7.1 to 7.8 of Text). **8 Hours**	L1, L2
Module-5	
Message Passing and Deadlocks: Overview of Message Passing, Implementing message passing, Mailboxes, Deadlocks, Deadlocks in resource allocation, Handling deadlocks, Deadlock detection algorithm, Deadlock Prevention (Topics from Sections 10.1 to 10.3, 11.1 to 11.5 of Text). **8 Hours**	L1, L2

5.0 Relevance to future subjects

Sl. No.	Semester	Subject	Topics
01	VIII	Project work	Basics of OS

6.0 Relevance to Real World

SL. No	Real World Mapping
01	Analyze different types of OS.
02	Design of different types of applications using OS.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	NPTEL	https://nptel.ac.in/courses/106106144/

8.0 Books Used and Recommended to Students

Text Books
Operating Systems – A concept based approach, by Dhamdare, TMH, 2nd edition.
Reference Books
1. Operating systems concepts, Silberschatz and Galvin, John Wiley India Pvt. Ltd, 5th edition,2001. 2. Operating system–internals and design system, William Stalling, Pearson Education, 4th ed, 2006. 3. Design of operating systems, Tannanbhaum, TMH, 2001.
Additional Study material & e-Books
3. NPTEL notes and Videos

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References
06) https://nptel.ac.in/courses/106106144/

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	Website
1	IEEE Xplorer	https://ieeexplore.ieee.org/Xplore/home.jsp

11.0 Examination Note

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination: Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

12.0 Course Delivery Plan

Course Delivery Plan:

MODULE	LECTURE NO.	CONTENT OF LECTURE	% OF PORTION
1	1	**Module 1**: **Introduction to Operating Systems:** OS, Goals of an OS	20
	2	Operation of an OS	
	3	Computational Structures	
	4	Resource allocation techniques, Efficiency	
	5	System Performance and User Convenience	
	6	Classes operating System	
	7	Batch processing, Multi programming,	
	8	Time Sharing Systems, Real Time and distributed Operating Systems	

2	9	**Module 2: Process Management:** OS View of Processes	40
	10	PCB	
	11	Fundamental State Transitions of a process	
	12	Threads	
	13	Kernel and User level Threads	
	14	Non-preemptive scheduling- FCFS and SRN,	
	15	Preemptive Scheduling- RR and LCN,	
	16	Scheduling in Unix and Scheduling in Linux	
3	17	**Module 3: Memory Management:** Contiguous Memory allocation	60
	18	Non-Contiguos Memory Allocation	
	19	Paging, Segmentation	
	20	Segmentation with paging	
	21	Virtual Memory Management	
	22	Demand Paging, VM handler	
	23	FIFO, LRU page replacement policies	
	24	Virtual memory in Unix and Linux	
4	25	**Module 4: File Systems:** File systems and IOCS	80
	26	File Operations	
	27	File Organizations	
	28	Directory structures	
	29	File Protection	
	30	Interface between File system and IOCS	
	31	Allocation of disk space	
	32	Implementing file access	
5	33	**Module 5: Message Passing and Deadlocks:** Overview of Message Passing	100
	34	Implementing message passing	
	35	Mailboxes	
	36	Deadlocks	
	37	Deadlocks in resource allocation	
	38	Handling deadlocks	
	39	Deadlock detection algorithm	
	40	Deadlock Prevention	

13.0 University Result

Examination	No. of students appeared	No. of students passed	% Passing
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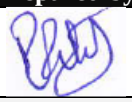
			
Prof. P.V.PATIL	**Prof. S.S.PATIL**	**HOD**	**Principal**

Subject Title	**MICROCONTROLLERS Lab**		
Subject Code	**BECL456A**	**CIE Marks**	50
Teaching Hours/Week (L:T:P) 0:0:2	0:0:2	**SEE Marks**	50
Exam Hrs	2	**Credits**	01
Examination type(SEE)	Practical	**Total Marks**	100

FACULTY DETAILS:		
Name: Prof. B. P. Khot	**Designation:** Assistant Professor	**Experience : 9**yr
No. of times course taught: 04	**Specialization:** Microelectronics and control systems	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
02	ECE	II	Basic Electronics / Introduction to electronics and communication

2.0 Course Objectives

This course will enable students to:

- Understand the basic programming of Microcontrollers.
- Develop the 8051 Microcontroller-based programs for various applications using Assembly Language & C Programming.
- Program 8051 Microcontroller to control an external hardware using suitable I/O ports.

3.0 Course Outcomes

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

	Course Outcome	RBT Level	POs
C224.1	Write an Assembly Language/C program in 8051 for solving simple problems that manipulate input data using different	L2	1,2,3,4,5,6,8, 10,11,12
C224.2	Develop testing and experimental procedures on 8051 Microcontroller. Analyze their operation under different cases.	L2	1,2,3,4,5,6,8, 10,11,12
C224.3	Develop programs for 8051 Microcontroller to implement real-world problems.	L3	1,2,3,4,5,6,8, 10,11,12
C224.4	Develop Microcontroller applications using external hardware interface.	L3	1,2,3,4,5,6,8, 10,11,12
Total Hours of instruction		**2hr/week *6 (batch) =12**	

4.0 Course Content

Course Content:

Execute the following experiments by using Keil Micro vision Simulator (any 8051 Microcontroller can be chosen as the target) and Hardware Interfacing Programs using 8051 Trainer Kit.
I. Assembly Language Programming
1. Write an ALP to move a block of n bytes of data from source (20h) to destination (40h) using Internal-RAM. 2. Write an ALP to move a block of n bytes of data from source (2000h) to destination (2050h) using External RAM. 3. Write an ALP To exchange the source block starting with address 20h, (Internal RAM) containing N (05) bytes of data with destination block starting with address 40h (Internal RAM). 4. Write an ALP to exchange the source block starting with address 10h (Internal memory), containing n (06) bytes of data with destination block starting at location 00h (External memory).
Arithmetic & Logical Operation Programs:
5. Write an ALP to add the byte in the RAM at 34h and 35h, store the result in the register R5 (LSB) and R6 (MSB), using Indirect Addressing Mode. 6. Write an ALP to subtract the bytes in Internal RAM 34h &35h store the result in register R5 (LSB) & R6 (MSB). 7. Write an ALP to multiply two 8-bit numbers stored at 30h and 31h and store16- bit result in 32h and 33h of Internal RAM. 8. Write an ALP to perform division operation on 8-bit number by 8-bit number. 9. Write an ALP to separate positive and negative in a given array. 10. Write an ALP to separate even or odd elements in a given array. 11. Write an ALP to arrange the numbers in Ascending & Descending order. 12. Write an ALP to find Largest & Smallest number from a given array starting from 20h & store it in Internal Memory location 40h
Counter Operation Programs:
13. Write an ALP for Decimal UP-Counter. 14. Write an ALP for Decimal DOWN-Counter. 15. Write an ALP for Hexadecimal UP-Counter. 16. Write an ALP for Hexadecimal DOWN-Counter.
II. C Programming
1. Write an 8051 C program to find the sum of first 10 Integer Numbers. 2. Write an 8051 C program to find Factorial of a given number. 3. Write an 8051 C program to find the Square of a number (1 to 10) using Look-Up Table. 4. Write an 8051 C program to count the number of Ones and Zeros in two consecutive memory locations.
Hardware Interfacing Programs
1. Write an 8051 C Program to rotate stepper motor in Clock & Anti-Clockwise direction. 2. Write an 8051 C program to Generate Sine & Square waveforms using DAC interface.

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	V &VIII	Project work	Embedded Systems

6.0 Relevance to Real World

SL. No	Real World Mapping
01	Microcontroller is used to design the Embedded systems design.
02	Microcontroller is used to design the Real time system with specific application.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Application of Microcontrollers in Real time Embedded systems.
02	NPTEL	Latest Controllers introduced.

8.0 Books Used and Recommended to Students

Text Books
1. "The 8051 Microcontroller: Hardware, Software and Applications" ,V Udayashankara and M S Mallikarjuna Swamy, McGraw Hill Education, 1st edition, 2017.

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References
1) https://nptel.ac.in/courses/108105102
2) https://nptel.ac.in/courses/117104072

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	The 8051 Microcontroller	https://timeline.intel.com/
2	IEEE Transactions on Microcontroller	ieeexplore.ieee.org
3	Microcontroller & Embedded design - Journal - Elsevier	www.journals.elsevier.com
4	International Journal Microcontrollers	ijdcn.co.in

11.0 Examination Note

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.

The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation (CIE):
CIE marks for the practical course are 50 Marks.

The split-up of CIE marks for record/journal and test are in the ratio 60:40.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up.

- Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus, and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to 20 marks (40% of the maximum marks).
- The sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are **50 Marks**.
- SEE shall be conducted jointly by **two examiners** from the same institute. Examiners are appointed by the **Head of the Institute**.
- The examination schedule and names of examiners are informed to the university before conducting the examination.
- These practical examinations must be conducted **within the schedule** mentioned in the academic calendar of the university.
- All laboratory experiments are to be included for the practical examination.

Rubrics and Evaluation Guidelines:

- **Breakup of marks** and the instructions printed on the cover page of the answer script are to be strictly adhered to by the examiners.
- OR, based on the course requirement, **evaluation rubrics** shall be decided jointly by the examiners.
-

Examination Process:

- Students can **pick one question (experiment)** from the question slot prepared jointly by the examiners.
- Evaluation will include:
  - **Test write-up**: 20%
  - **Conduction procedure and result**: 60%
  - **Viva-voce**: 20%
- SEE for practical shall be evaluated for **100 marks**, and the scored marks will be **scaled down to 50 marks**.
  - However, based on the course type, rubrics can be decided by the examiners.

- **Change of experiment** is allowed only once, and **15% of marks** allotted to the procedure part will be deducted.
- The **minimum duration of SEE** is **02 hours**.

12.0 Course Delivery Plan

Course Delivery Plan:

Expt. NO.	CONTENT OF LECTURE	% OF PORTION
	I. Assembly Language Programming	
1	Write an ALP to move a block of n bytes of data from source (20h) to destination (40h) using Internal-RAM.	20
2	Write an ALP to move a block of n bytes of data from source (2000h) to destination (2050h) using External RAM.	
3	Write an ALP To exchange the source block starting with address 20h, (Internal RAM) containing N (05) bytes of data with destination block starting with address 40h (Internal RAM).	
4	Write an ALP to exchange the source block starting with address 10h (Internal memory), containing n (06) bytes of data with destination block starting at location 00h (External memory).	
	Arithmetic & Logical Operation Programs	
5	Write an ALP to add the byte in the RAM at 34h and 35h, store the result in the register R5 (LSB) and R6 (MSB), using Indirect Addressing Mode.	40
6	Write an ALP to subtract the bytes in Internal RAM 34h &35h store the result in register R5 (LSB) & R6 (MSB).	
7	Write an ALP to multiply two 8-bit numbers stored at 30h and 31h and store16- bit result in 32h and 33h of Internal RAM.	
8	Write an ALP to perform division operation on 8-bit number by 8-bit number.	
9	Write an ALP to separate positive and negative in a given array.	
10	Write an ALP to separate even or odd elements in a given array.	
11	Write an ALP to arrange the numbers in Ascending & Descending order.	
12	Write an ALP to find Largest & Smallest number from a given array starting from 20h & store it in Internal Memory location 40h	
	Counter Operation Programs	
13	Write an ALP for Decimal UP-Counter.	15
14	Write an ALP for Decimal DOWN-Counter.	
15	Write an ALP for Hexadecimal UP-Counter.	
16	Write an ALP for Hexadecimal DOWN-Counter.	
	II. C Programming	
17	Write an 8051 C program to find the sum of first 10 Integer Numbers.	15
18	Write an 8051 C program to find Factorial of a given number.	
19	Write an 8051 C program to find the Square of a number (1 to 10) using Look-Up Table.	
20	Write an 8051 C program to count the number of Ones and Zeros in two consecutive memory locations.	

Expt. NO.	CONTENT OF LECTURE	% OF PORTION
	Hardware Interfacing Programs	
21	Write an 8051 C Program to rotate stepper motor in Clock & Anti-Clockwise direction.	10
22	Write an 8051 C program to Generate Sine & Square waveforms using DAC interface.	
	TOTAL	100%

11.0 QUESTION BANK

Assembly Language Programming:

1. What is the purpose of the `MOV` instruction in Assembly language?
2. Explain the difference between Internal-RAM and External-RAM in the context of microcontroller programming.
3. How does the `MOVX` instruction differ from the regular `MOV` instruction?
4. Describe the significance of the accumulator (`A`) register in Assembly language programming for microcontrollers.
5. Explain how the `DJNZ` instruction works and provide an example scenario where it would be useful.
6. What is Indirect Addressing Mode, and how is it used in Assembly language programming?
7. Discuss the importance of using loop constructs in Assembly language programs.
8. How do you handle data overflow or underflow when performing arithmetic operations in Assembly language?
9. Explain the purpose and usage of the `INC` instruction.
10. Describe the role of the `DPTR` register in Assembly language programming for microcontrollers.

C Programming for 8051:

1. What are the advantages of using C programming for 8051 microcontrollers compared to Assembly language?
2. How do you declare and initialize variables in C programming for 8051 microcontrollers?
3. Explain the concept of a Look-Up Table (LUT) and its application in embedded systems programming.
4. Describe the process of interfacing external hardware components with an 8051 microcontroller using C programming.
5. Discuss the significance of using header files in C programming for microcontrollers.
6. Explain the purpose of pointers in C programming and provide an example of their usage in the context of microcontroller programming.
7. How do you handle interrupts in C programming for 8051 microcontrollers?

8. Discuss the memory organization of an 8051 microcontroller and its implications for C programming.
9. Describe the role of bit manipulation operators in C programming for microcontrollers.
10. Explain how to perform input/output operations with ports in C programming for 8051 microcontrollers.

Hardware Interfacing Programs:

1. What are the key considerations when interfacing a stepper motor with an 8051 microcontroller?
2. Explain the operation of a Digital-to-Analog Converter (DAC) and its interface with an 8051 microcontroller.
3. Discuss the principles behind generating sine and square waveforms using a DAC interface.
4. How do you handle timing constraints and synchronization issues when interfacing hardware with an 8051 microcontroller?
5. Describe the steps involved in rotating a stepper motor in clockwise and counterclockwise directions using an 8051 microcontroller.
6. Discuss the importance of feedback mechanisms in controlling hardware components with an 8051 microcontroller.
7. Explain the role of pulse-width modulation (PWM) in controlling the speed of motors or the brightness of LEDs.
8. How do you ensure compatibility and proper voltage levels when interfacing external components with an 8051 microcontroller?
9. Discuss the limitations and challenges of hardware interfacing with 8051 microcontrollers and potential solutions.
10. Describe the process of debugging and testing hardware interfacing programs for 8051 microcontrollers.

13.0 University Result

Examination	FCD	FC	SC	% Passing
June/July 2021	-	-	-	100
June /July2024	-	-	-	100

Prepared by	Checked by		
Prof. B. P. Khot	Prof. P. V. Patil	HOD	Principal

Subject Title	Biology for Engineers		
Subject Code	BBOK407	**CIE Marks**	50
		SEE Marks	50
Number of Lecture Hrs/	3	**Total Marks**	100
Total Number of Lecture	40 hours Theory	**Exam Hours**	03
CREDITS – 03			

FACULTY DETAILS:		
Name: Dr. M. S. Hanagadakar	**Designation:** Associate Professor	**Experience:** 19.0 Years
No. of times course taught: 03 (including Present)	**Specialization:** Physical Chemistry	

1.0 Prerequisite Subjects:

To familiarize the students with the basic biological concepts and their engineering applications

Sl. No	Branch	Semester	Subject
01	Common to all	IV	Biology for Engineers

2.0 Course Objectives

To provide students with knowledge of Biology for building technical competence in industries, research and development in the following fields

1. To familiarize the students with the basic biological concepts and their engineering applications.
2. To enable the students with an understanding of bio design principles to create novel devices and structures.
3. To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
4. To motivate the students develop the interdisciplinary vision of biological engineering.

3.0 Course Outcomes

On completion of this course, students will have knowledge in:

	Course Outcome	POs	RBT Levels
CO1	To familiarize the students with the basic biological concepts and their engineering applications.	1,2,3,& 7	L3
CO2	To enable the students with an understanding of bio design principles to create novel devices and structures.	1,2,3, & 7	L1 &L2
CO3	To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.	1,2,3, & 7	L3
CO4	To motivate the students to develop interdisciplinary vision of biological engineering.	1,2,3, & 7	L3
CO5	Understand the Trends of Bioengineering	1,2,3, & 7	L1&L2
Total Hours of instruction		**40**	

4.0 Course Content

Module-1: INTRODUCTION TO BIOLOGY:
The cell: the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules; Enzymes (Classification (with one example each),Properties and functions), vitamins and hormones.

Module 2: BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE)::
Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents/detergents), Enzymes
(glucose-oxidase in biosensors, lingo lytic enzyme in bio-bleaching).

Module 3: HUMAN ORGAN SYSTEMS AND BIO DESIGNS (QUALITATIVE): (Qualitative):
Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signaling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).

Module 4: NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (Qualitative):
Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflouro carbons (PFCs).

Module 5: TRENDS IN BIOENGINEERING (Qualitative):
Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis), scaffolds and tissue engineering, Bio printing techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bio imaging and Artificial Intelligence for disease diagnosis. Self- healing Bio concrete (based on bacillus spores, calcium lactate nutrients and bio mineralization processes) and Bioremediation and Bio mining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	IV	**Biology for Engineers** (Common to all Engineering subjects)	Introduction to fundamental aspects of Biology for Engineers in IV semester Students will learn about the demand for improvement in medical and biological studies and research, it has become important to use technology. One can easily transform biological data and information into a realistic approach. Biology for Engineers has made it possible to understand the living world in depth. It is a broad area of study which has successfully brought great advancements in our lives. Interestingly, the ever-changing and diverse field has led humans to achieve scientific excellence. India has geared to be an International player in life sciences.

6.0 Relevance to Real World

SL.No	Real World Mapping
01	To illustrates many potential applications of biology for engineering, and to demonstrates the possible use and impact of these tools and technologies to address and overcome societal challenges, through a focus on five sectors: 1) Industrial Biotechnology; 2) Health & Medicine; 3) Food & Agriculture; 4) Environmental Biotechnology; and 5) Energy.
02	To frame these possibilities through the lens of solving pervasive societal challenges, including enabling and establishing a cleaner environment, supporting the health and well-being of growing populations, and accelerating innovation and economic viability of industry.
03	Science and engineering aims and objectives for biology for engineering that may be necessary or instrumental to overcoming the challenge and identify potential discrete technical achievements towards the objective.
04	Engineering departments in which students work in teams to tackle a "real-world" engineering design problem related to biological sciences.
05	As our engineering toolkit in bio expands to be more powerful than ever before, and the infrastructure to deliver, produce, and scale these solutions, a whole new world of problems in biology begin to feel approachable.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	VTU EDUSAT / SWAYAM / NPTEL / MOOCS / Coursera / MIT-open learning resource	Each module/ Chapter presentation

8.0 Books Used and Recommended to Students

Suggested Learning Resources: Textbooks/ Reference Books

1. Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
2. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
3. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
4. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
5. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
6. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
7. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
8. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
9. Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N GeethaA C Udayashankar Lambert Academic Publishing, 2019.
10. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
11. Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016

Additional Study material & e-Books

1. Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar Lambert Academic Publishing, 2019.
2. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
3. Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016 .
4. Blood Substitutes, Robert Winslow, Elsevier, 2005

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References

1. https://nptel.ac.in/courses/121106008
2. https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
3. https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
4. https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
5. https://www.coursera.org/courses?query=biology
6. https://onlinecourses.nptel.ac.in/noc19_ge31/preview
7. https://www.classcentral.com/subject/biology
8. https://www.futurelearn.com/courses/biology-basic-concepts

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Group Discussion of Case studies
2. Model Making and seminar/poster presentations
3. Design of novel device/equipment like Cellulose-based water filters, Filtration system

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	**Journal of Theoretical Biology**	https://www.sciencedirect.com/journal/journal-of-theoretical-biology
2	**Journal of Virology**	https://journals.asm.org/journal/jvi

11.0 Examination Note

Assessment Details (both CIE and SEE)

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 2 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

The theory portion of the Integrated Course shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

SCHEME OF EXTERNAL EXAMINATION:

Ten main questions to be set in question paper. Each main question will carry 20 marks. Student has to answer either 1 or 2 main question. It will continue up to 10th question.

Module I– Question 1(a,b) or 2(a,b) = 20Marks
Module II – Question 3(a,b) or 4(a,b) = 20Marks
Module III– Question 5(a,b) or 6(a,b) = 20Marks
Module IV – Question 7(a,b) or 8(a,b) = 20Marks
Module V – Question 9(a,b) or 10(a,b) = 20Marks
Total = 100Marks

INSTRUCTION FOR Biology for Engineers (BBOK407) EXAMINATION

- The total exam duration is 3 hours.
- Use black ink pen for writing examination
- Drawing should be drawn from dark pencil.
- Read the questions carefully.
- Answer the questions up to the point.

12.0 Course Delivery Plan

Module No.	Lecture No.	Content of Lecture	% of Portion
I	1	The cell: the basic unit of life, Structure and functions of a cell	20.0
	2	The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells and their application.	
	3	Biomolecules: Properties and functions of Carbohydrates, Nucleic acids,	
	4	proteins, lipids. Importance of special biomolecules;	
	5	Enzymes (Classification (with one example each),Properties and functions), vitamins and hormones.	
II	1	Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics),	20.0
	2,	Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19	
	3	Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins),	
	4	lipids (biodiesel, cleaning agents/detergents),	
	5	Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching).	
3	1	Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics	20.0
	2	Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye).	
	3	Heart as a pump system (architecture, electrical signaling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators).	
	4	Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine).	
	5	Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).	
4	1	Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf).	20.0
	2	Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces),	
	3	Plant burrs (Velcro), Shark skin (Friction reducing swim suits),	
	4	Kingfisher beak (Bullet train).	
	5	Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflouro carbons (PFCs).	
5	1	Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis),	20.0
	2	scaffolds and tissue engineering, Bio printing techniques and materials, 3D printing of ear, bone and skin. 3D printed foods.	
	3	Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bio imaging and Artificial Intelligence for disease diagnosis	
	4	Self- healing Bio concrete (based on bacillus spores, calcium lactate nutrients and bio mineralization processes) and Bioremediation	
	5	Bio mining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).	

13.0 QUESTION BANK

MODULE-I INTRODUCTION TO BIOLOGY:

1. Define cell. Explain Characteristics of Cells.
2. Explain structure and functions of Prokaryotic Cells (With diagram)
3. Explain structure and functions of Eukaryotic Cells (With diagram))
4. Explain the applications of Prokaryotic Cells
5. Explain the applications of Eukaryotic Cells
6. Define stem cells. Explain the following types of stem cells
    a) Embryonic Stem Cells
    b) Adult Stem Cells
    c) Induced Pluripotent Stem Cells
    d) Mesenchymal stem cells
7. Explain the applications of stem cells:
8. What are carbohydrates? Explain properties and functions of Carbohydrates.
9. What are Nucleic acids? Explain properties and functions of Nucleic acids.
10. Define Biomolecules. Explain the structure (types) of Nucleic Acids.
11. Define Biomolecules. Explain the structure (types) of carbohydrates.
12. What are carbohydrates? Explain Classification of carbohydrates
13. Explain industrial applications of Carbohydrates
14. Explain properties, advantages and limitations of cellulose based water filter
15. Explain Construction of cellulose-based water filters
16. Explain with suitable diagram water filtration using cellulose membrane
17. Discuss the potential of cellulose based water filters addressing water pollution issues. What are its advantages and limitations
18. Explain properties and Engineering applications of PHA bioplastic.
19. Explain properties and Engineering applications of PLA bioplastic.
20. What are Nucleic Acids? Explain two types of nucleic acids (DNA and RNA)
21. Describe the following i) RNA Vaccines for Covid19 ii) DNA Fingerprinting.
22. Write a note on DNA vaccine.
23. Explain DNA vaccine for rabies and
24. Write a note on RNA vaccine
25. Explain RNA Vaccines for Covid19 with its importance.

MODULE 2: BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE):

1. Explain comparison between human brain and CPU system.
2. Compare and contrast Central Nervous System (CNS) and Peripheral Nervous System (PNS) in terms of their structure and functions.
3. Discuss the types of brain activity that can be detected by EEG (Electro-Encephalo-Graphy).
4. Discuss the applications of EEG (Electro-Encephalo-Graphy).
5. Explain the Robotic Arm Prosthetic Direct Control through Muscle Signals. (myo-electric control)
6. Explain the Robotic Arm Prosthetic by Brain-Machine Interfaces.
7. Discuss the Engineering Solutions for Parkinson's disease.
8. Discuss the main components of the eye that correspond to a camera system
9. Explain the Architecture of Rod and Cone cells with the neat diagram.
10. Explain Optical corrections refer to devices or techniques used to improve or correct vision problems caused by a refractive error in the eye.
11. Explain cataract clouding of the lens of the eye that affects vision and mention artificial lenses used in cataract surgery or for vision correction.
12. Define Bionic Eye or Artificial Eye. Mention the materials used in a bionic eye and explain working of Bionic Eye.
13. Explain the architecture of Heart as a Pump System.
14. Explain how the heart's pumping/ Heart beating action is controlled by a complex network of electrical and chemical signals,
15. Explain how Electrical Signaling – ECG helps in monitoring and Heart Related Issues.
16. Describe the reasons for Blockages of Blood Vessels.
17. Write a note on Design of Stents
18. Define Pace Makers. Explain the basic design of a pacemaker and construction.
19. Define Defibrillators. Explain the basic design of a defibrillator consists.
20. Explain the Construction of defibrillators.

21. Explain the Automated External Defibrillators an Implantable Cardioverter Defibrillators.
22. Write a note on Artificial Heart.

MODULE 3: HUMAN ORGAN SYSTEMS AND BIO DESIGNS (QUALITATIVE):

1. Explain comparison between human brain and CPU system.
2. Compare and contrast Central Nervous System (CNS) and Peripheral Nervous System (PNS) in terms of their structure and functions.
3. Discuss the types of brain activity that can be detected by EEG (Electro-Encephalo-Graphy).
4. Discuss the applications of EEG (Electro-Encephalo-Graphy).
5. Explain the Robotic Arm Prosthetic Direct Control through Muscle Signals. (myo-electric control)
6. Explain the Robotic Arm Prosthetic by Brain-Machine Interfaces.
7. Discuss the Engineering Solutions for Parkinson's disease.
8. Discuss the main components of the eye that correspond to a camera system
9. Explain the Architecture of Rod and Cone cells with the neat diagram.
10. Explain Optical corrections refer to devices or techniques used to improve or correct vision problems caused by a refractive error in the eye.
11. Explain cataract clouding of the lens of the eye that affects vision and mention artificial lenses used in cataract surgery or for vision correction.
12. Define Bionic Eye or Artificial Eye. Mention the materials used in a bionic eye and explain working of Bionic Eye.
13. Explain the architecture of Heart as a Pump System.
14. Explain how the heart's pumping/ Heart beating action is controlled by a complex network of electrical and chemical signals,
15. Explain how Electrical Signaling – ECG helps in monitoring and Heart Related Issues.
16. Describe the reasons for Blockages of Blood Vessels.
17. Write a note on Design of Stents
18. Define Pace Makers. Explain the basic design of a pacemaker and construction.
19. Define Defibrillators. Explain the basic design of a defibrillator consists.
20. Explain the Construction of defibrillators.
21. Explain the Automated External Defibrillators an Implantable Cardioverter Defibrillators.
22. Write A NOTE ON ARTIFICIAL HEART.

MODULE 4: NATURE-BIO-INSPIRED MATERIALS AND MECHANISMS (QUALITATIVE):
Echolocation (Ultrasonography, Sonars)

1. **Describe the principles of echolocation and how it is utilized in ultrasonography for medical diagnostics.**
2. **Explain the working mechanism of sonar technology and its applications in underwater exploration and navigation.**

Photosynthesis (Photovoltaic Cells, Bionic Leaf)

3. **Describe the process of photosynthesis and explain how it has inspired the development of photovoltaic cells.**
4. **Explain the concept of a bionic leaf and how it mimics natural photosynthesis to produce renewable energy. Mention what its potential applications.**

Bird Flying (GPS and Aircrafts)

5. **Discuss the mechanisms of bird flight and how they have inspired the design and navigation systems of modern aircraft.**
6. **Explain how birds use natural GPS for navigation and how this knowledge has influenced the development of GPS technology in aviation.**

Lotus Leaf Effect (Super hydrophobic and Self-Cleaning Surfaces)

7. **Describe the lotus leaf effect and explain how it has been applied to create super hydrophobic and self-cleaning surfaces.**
8. **Discuss the potential applications and benefits of super hydrophobic surfaces inspired by the lotus leaf effect in various industries.**

Plant Burrs (Velcro)

9. **Explain how the structure of plant burrs inspired the invention of Velcro and describe the mechanism of its adhesive properties.**

10. **Discuss the various applications of Velcro in everyday life and industry, highlighting its versatility and impact.**

Shark Skin (Friction-Reducing Swim Suits)

11. **Describe how the structure of shark skin reduces friction in water and how this has been utilized in the design of swim suits.**
12. **Explain the benefits of friction-reducing swim suits for athletes and other potential applications of this technology.**

Kingfisher Beak (Bullet Train)

13. **Explain how the shape of the kingfisher beak inspired the design of bullet trains and discuss the aerodynamic benefits.**
14. **Discuss the improvements in speed and energy efficiency of bullet trains due to the kingfisher beak-inspired design.**

Human Blood Substitutes - Hemoglobin-Based Oxygen Carriers (HBOCs) and Perfluorocarbons (PFCs)

15. **Describe the development and functioning of hemoglobin-based oxygen carriers (HBOCs) as blood substitutes.**
16. **Explain the role of perfluorocarbons (PFCs) in oxygen transport and their potential applications as blood substitutes.**
17. **Discuss the advantages and challenges associated with the use of HBOCs and PFCs in medical treatments.**

MODULE 5: TRENDS IN BIOENGINEERING (QUALITATIVE):

Muscular and Skeletal Systems

1. **Describe the architectural design of the muscular system and how it facilitates movement in the human body.**
2. **Explain the mechanisms involved in muscle contraction and relaxation.**
3. **Discuss the role of the skeletal system as a scaffold for the body, highlighting its structural and functional importance.**
4. **Describe bioengineering solutions for muscular dystrophy and osteoporosis focusing on current advancements and future prospects.**
5. **Explain the pathophysiology of osteoporosis and discuss bioengineering approaches to treat or manage this condition.**

Scaffolds and Tissue Engineering

6. **Describe the role of scaffolds in tissue engineering and how they contribute to the regeneration of damaged tissues.**
7. **Explain the different materials used for scaffolds in tissue engineering and their respective advantages and disadvantages.**
8. **Discuss the process of creating scaffolds for tissue engineering and the criteria for selecting suitable materials.**

Bio printing Techniques and Materials

9. **Describe the process of bio printing and the materials commonly used in this technology.**
10. **Explain the challenges and potential solutions in the bio printing of complex tissues and organs.**

3D Printing of Ear, Bone, and Skin

11. **Discuss the advancements in 3D printing technology for the reconstruction of the ear, including materials and methods used.**
12. **Explain how 3D printing is used to create bone scaffolds and the potential impact on orthopedic surgery.**
13. **Describe the process of 3D printing skin and its applications in treating burns and other skin injuries.**

3D Printed Foods

14. **Explain the concept of 3D printed foods and the technology used to produce them.**
15. **Discuss the potential benefits and challenges associated with 3D printed foods.**

Electrical Tongue and Electrical Nose in Food Science

16. **Describe the working principles of an electronic tongue and electronic nose its applications in food science.**

17. **Explain the role of an electronic nose in detecting food quality and safety, and compare its performance to traditional methods.**

DNA Origami and Biocomputing

18. **Describe the concept of DNA origami and its potential applications in nanotechnology and medicine.**
19. **Explain the principles of bio computing and discuss how biological systems can be used for computational purposes.**

Bio imaging and Artificial Intelligence for Disease Diagnosis

20. **Discuss the advancements in bio imaging techniques and their significance in disease diagnosis.**
21. **Explain how artificial intelligence is being integrated into bio imaging to enhance disease diagnosis and treatment planning.**

Self-healing Bio concrete

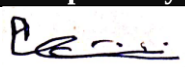
22. **Describe the concept of self-healing bio concrete and the role of Bacillus spores in the healing process.**
23. **Explain the process of bio mineralization in self-healing bio concrete and its potential applications in construction.**

Bioremediation and Bio mining via Microbial Surface Adsorption

24. **Explain the principles of bioremediation and how microbial surface adsorption is used to remove heavy metals from the environment.**
25. **Discuss the process of bio mining and how microorganisms can be utilized to extract valuable metals from ores.**

14.0 University Result

Examination	S+	S	A	B	C	D	E	F	% Passing

Prepared by	Checked by		
			
Dr. M. S. Hanagadakar	**(Dr. M. S. Hanagadakar)**	**HOD**	**Principal**

Subject Title	Universal Human Values		
Subject Code	BUHK408	**CIE Marks**	50
Teaching Hrs / Week	02	**SEE Marks**	50
Total Hrs of Pedogogy	15	**Exam Hours**	01
			CREDITS –

FACULTY DETAILS:		
Name: 1. Prof. K. S. Patil Prof. S. M. Patil	**Designation:** 1.Asst. Professor 2. Asst. Professor	**Experience:** 1. T**:** 31 Years 2. 3 Years
No. of times course taught: 01 Times	**Specialization:** Industrial Electronics	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	None	--	--

2.0 Course Objectives

This introductory course input is intended:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

3.0 Course Outcomes

By the end of the course, students are expected to positively impact common graduate attributes like:

CO	Course Outcome	Cognitive Level	PO's
C229.1	Ethical human conduct	L_2	PO6, PO7 PO8, PO10, PO12
C229.2	Socially responsible behavior	L_2	PO6, PO7 PO8, PO10, PO12
C229.3	Holistic vision of life	L_2	PO6, PO7 PO8, PO10, PO12
C229.4	Environmentally responsible work	L_2	PO6, PO7 PO8, PO10, PO12
C229.5	Having Competence and Capabilities for Maintaining Health and Hygiene. Appreciation and aspiration for excellence (merit) and gratitude for	L_2	PO6, PO7 PO8, PO10, PO12
Total Hours of instruction		**15**	

4.0 Course Content

Module-1

Introduction to Value Education (3 hours) Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

Module-2

Harmony in the Human Being (3 hours) Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

Module-3

Harmony in the Family and Society (3 hours) Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

Module-4

Harmony in the Nature/Existence (3 hours) Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

Module-5

Implications of the Holistic Understanding – a Look at Professional Ethics (3 hours) Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

5.0 Relevance to future subjects:

SL. No	Semester	Subject	Topics / Relevance
01	------	None	--------

6.0 Relevance to Real World

SL. No	Real World Mapping
01	Self enhancement, Openness to change, Self-transcendence & Conservation.

7.0 Books Used and Recommended to Students

Text Books

a. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
b. The Teacher‟s Manual ‟ Manual for A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G

Reference Books

1. JeevanVidya: E k Parichaya, A Nagaraj, JeevanVidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)
14. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
15. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
16. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
17. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
18. A N Tripathy, 2003, Human Values, New Age International Publishers
19. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
20. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
21. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
22. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
23. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

8.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Web links and Video Lectures (e-Resources):

1. Value Education websites, https://www.uhv.org.in/uhv-ii, http://uhv.ac.in, http://www.uptu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
4. https://fdp-si.aicte-india.org/8dayUHV_download.php
5. https://www.youtube.com/watch?v=8ovkLRYXIjE
6. https://www.youtube.com/watch?v=OgdNx0X923I
7. https://www.youtube.com/watch?v=nGRcbRpvGoU
8. https://www.youtube.com/watch?v=sDxGXOgYEKM

9.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals
1	Al Gore, An Inconvenient Truth, Paramount Classics, USA
2	**Charlie Chaplin, Modern Times, United Artists, USA**
3	IIT Delhi, Modern Technology – the Untold Story
4	Gandhi A., Right Here Right Now, Cyclewala Productions.

10.0 Examination Note

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous internal Examination (CIE)

1. For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
2. The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
3. Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
4. For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

The sum of two tests, two assignments, will be out of 100 marks and will be scaled down to 50 marks. Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure a minimum of 35% of the maximum marks meant for SEE.

11.0 Course Delivery Plan

Module	Lecture No.	Content of Lecture	% of Portion
I	1	Right Understanding, Relationship and Physical Facility. Understanding Value Education, Self-exploration as the Process for Value Education.	20%
	2	Continuous Happiness and Prosperity – the Basic Human Aspirations.	
	3	Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.	
II	4	Harmony in the Human Being Understanding Human being as the Co-existence of the Self and the Body.	20%
	5	Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self.	
	6	Understanding Harmony in the Self, Harmony of the Self with the Body. Programme to ensure self-regulation and Health.	
III	7	Harmony in the Family and Society, the Basic Unit of Human Interaction.	20%
	8	'Trust' – the Foundational Value in Relationship.	
	9	'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship. Understanding Harmony in the Society, Vision for the Universal Human Order	
IV	10	Harmony in the Nature/Existence Understanding Harmony in the Nature.	20%
	11	Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature.	
	12	Realizing Existence as Co-existence at All Levels. The Holistic Perception of Harmony in Existence.	
V	13	Implications of the Holistic Understanding – a Look at Professional Ethics Natural Acceptance of Human Values.	20%
	14	Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order.	
	15	Competence in Professional Ethics Holistic Technologies. Strategies for Transition towards Value-based Life and Profession.	

12.0 QUESTION BANK

1. What is the state of liking and a holistic and all-encompassing state of the mind that creates inner harmony?
   a. Prosperity
   b. **Happiness**
   c. Innateness
   d. Self-organized

2. What is called living with assumption for oneself as body and Living of human being only on the basis of physical facilities, and not with right understanding and relationship?
   a. Human Consciousness
   b. Happiness
   c. Right Understanding

d. **Animal Consciousness**

3. Five basic guidelines for value education are Universal, Natural and verifiable, all encompassing, leading to harmony and
1. Self-exploration
2. Education
3. Right utilization
4. **Rational**

4. What are the basic desires of every human being for which they are working.
1. Physical facilities
2. Realization and understanding
3. Happiness and prosperity
4. **Continuous happiness and prosperity**

5. When we participate in the larger order, this participation at different levels is known as our value. Values are outcome of
1. Prosperity
2. Happiness
3. **Realization and understanding**
4. Self-exploration

6. Identify the solution which helps human being to transform from animal consciousness to human consciousness.
1. **Right understanding**
2. Realization
3. Value education
4. Physical facilities.

7. To maintain harmony we have to work at four levels of living. Identify second level of living.
1. Self
2. **Family**
3. Nature
4. Society

8. Self-exploration is a process which helps us to find out "What I am and What I really want to be ". Two mechanisms involved in self -exploration are
1. Realization and understanding
2. Natural and verifiable
3. **Natural acceptance and experimental validation**
4. Correctable and identifiable

9. Self-exploration uses two mechanisms
1. **Natural acceptance and experiential validation**
2. Right Understanding and self-exploration
3. Self-investigation and self-exploration
4. Natural acceptance and self-investigation

10. Samridhi means
1. Happiness
2. Wealth
3. **Prosperity**
4. Health

11. What is the third level of living?
    1. **Society**
    2. Individual
    3. Family
    4. Nature

12. Developed nations are the live example of
    1. **Prosperity**
    2. Wealth
    3. Happiness
    4. Health

13. The participation of human beings is seen in two forms
    1. Prosperity and Work
    2. Values and Understanding
    3. Behavior and Wealth
    4. **Behavior and Work**

14. What are the outcomes of realization and understanding?
    1. Work
    2. **Values**
    3. Happiness
    4. Health

15. We become ……. by exploring our svatva and living accordingly

    a. **Svatantra**
    b. Partantra
    c. Wealthy.
    d. Happy

16. Developed nations are the live example of health, wealth and wisdom. These three terms can be combined to form a single term as

    a. Developed
    b. **Prosperous**
    c. Harmony
    d. Happy

17. Contents of self-exploration area
    a. Desire and needs
    b. Program and needs
    c. Program and practical
    d. **Desire and Program**

18. Value education is becoming important for students now a day because value education helps students to correctly identify our….

    a. Values
    b. Key to success
    c. **Aspirations**
    d. Needs

19. Three results are obtained from realization and understanding. Two of them are assurance and satisfaction find third one

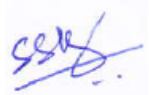
a. **Universality**
b. Acceptance
c. All-encompassing
d. Self-verification

20. The person who are lack of physical facility stands for

a. Samadhan viheendukhidaridra
b. Sadhan viihindukhidaridra
c. **Sadhan ViheenDukhi Daridra**
d. Sadhan vimukhdukhidaridra

13.0 University Result

Examination	FCD	FC	SC	% Passing
June/July- 2023	62	05	00	100
Aug/Sept -2024	63	01	01	100

Prepared by	Checked by		
			
Prof. K. S. Patil	**Prof. S. S. Kamate**	**HOD**	**Principal**