Government College of Engineering, Karad

PROPOSED SCHEME OF INSTRUCTION

Programme: Honors and Multidisciplinary Minor (Embedded Systems)

Minor: Semester – I (Major: Semester – IV)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	EXHO-0401	System Design using Embedded Processors	03	--	03	03	20	30	50
2	EXHO-0402	Competency Lab-I	--	02	02	01	--	50	50
		Total	**03**	**02**	**05**	**04**	**20**	**80**	**100**

Minor: Semester – II (Major: Semester – V)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	EXHO-0501	Embedded Programming	03	--	03	03	20	30	50
2	EXHO-0502	Competency Lab-II	--	02	02	01	--	50	50
		Total	**03**	**02**	**05**	**04**	**20**	**80**	**100**

Minor: Semester –III(Major: Semester – VI)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	EXHO -0601	Design of Digital Signal Processing System	03	--	03	03	20	30	50
2	EXHO -0602	Competency Lab-III	--	02	02	01	--	50	50
		Total	**03**	**02**	**05**	**04**	**20**	**80**	**100**

Minor: Semester –IV(Major: Semester – VII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							PBE-I	PBE-II	TOTAL
3	EXHO-0701	Professional Training & Mini-Project-I	--	06	06	03	50	50	100
		Total	**00**	**06**	**06**	**03**	**50**	**50**	**100**

Minor: Semester – IV (Major: Semester – VIII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							PBE-I	PBE-II	TOTAL
1	EXHO -0801	Major Capstone Project (Design&Development)	--	6	06	03	50	50	100
		Total	**--**	**06**	**06**	**03**	50	50	100

L- Lecture P-Practical

FA- Formative Assessment SA - Summative Assessment (For Laboratory End Semester performance)

PBE-I– Project-based Examination (For Laboratory Mid Semester Performance)

PBE- II Project-based Examination (For Laboratory End Semester Performance)

PROGRESSIVE TOTAL CREDITS: 18

Guidelines:-Students will take up 5-6 addittional course in the same Engineering/ Technology discipline of 18 credit distributed over semester III –VIII. These 18 credits will be over and above the 176 credits prescribed for four year multidisciplinary bachelor's degree in Engg/Tech Program.

Government College of Engineering, Karad

PROPOSED SCHEME OF INSTRUCTION

Programme: Honors with Research and Multidisciplinary Minor

Minor: Semester –IV(Major: Semester – VII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							PBE-I	PBE-II	TOTAL
3	EXHRO-0701	Research Project Phase -I	--	18	18	09	100	100	200
		Total	**--**	**18**	**18**	**09**	**100**	**100**	**200**

Minor: Semester – IV (Major: Semester – VIII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							PBE-I	PBE-II	TOTAL
1	EXHRO - 0801	Research Project Phase -II	--	18	18	09	100	100	200
		Total	**--**	**18**	**18**	**09**	**100**	**100**	**200**

L- Lecture P-Practical

FA- Formative Assessment SA - Summative Assessment (For Laboratory End Semester performance)

PBE-I– Project-based Examination (For Laboratory Mid Semester Performance)

PBE- II Project-based Examination (For Laboratory End Semester Performance)

PROGRESSIVE TOTAL CREDITS: 18

Guidelines:-Students will work on research project for 18 credits in the semester VII –VIII in the respective Major Engineering/Tecnology discipline. These 18 credits will be over and above the 176 credits prescribed for four year multidisciplinary bachelor's degree in Engg/Tech Program.

Government College of Engineering, Karad

PROPOSED SCHEME OF INSTRUCTION

Programme: Double Minors (Multidisciplinary and Specialization Minors)

(Major: Semester – III)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	EXDO-0301	Electronic Circuits	02	--	02	02	50	50	100
		Total	**02**	**--**	**02**	**02**	**50**	**50**	**100**

(Major: Semester – IV)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	EXDO-0401	Digital Electronics	02	--	02	02	50	50	100
		Total	**02**	**--**	**02**	**02**	**50**	**50**	**100**

(Major: Semester – V)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	EXDO-0501	Signals & Systems	03	--	03	03	50	50	100
2	EXDO -0502	Signals & Systems Laboratory	--	02	02	01	50	-	50
		Total	**03**	**02**	**05**	**04**	**100**	**50**	**150**

(Major: Semester – VI)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	EXDO-0601	Communication System	02	--	02	02	50	50	100
		Total	**02**	**--**	**02**	**02**	**50**	**50**	**100**

(Major: Semester – VII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	EXDO-0701	Microprocessor & Microcontroller	02	--	02	02	50	50	100
		Total	**02**	**--**	**02**	**02**	**50**	**50**	**100**

(Major: Semester – VIII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							PBE-I	PBE-II	TOTAL
1	EXDO -0801	Mobile Communication	02	--	02	02	50	50	100
2	EXDO -0802	Major Capstone Project (Design& Development)	--	08	08	04	50	50	100
		Total	**--**	**08**	**10**	**06**	100	100	200

L- Lecture P-Practical

FA- Formative Assessment SA - Summative Assessment (For Laboratory End Semester performance)

PBE-I– Project-based Examination (For Laboratory Mid Semester Performance)

PBE- II Project-based Examination (For Laboratory End Semester Performance)

PROGRESSIVE TOTAL CREDITS: 18

Guidelines:-Students will take up 5-6 addittional courses in another Engineering/ Technology/ Emerging Area of Specialization of 18 credit distributed over semester III –VIII. These 18 credits will be over and above the 176 credits prescribed for four year multidisciplinary bachelor's degree in Engg/Tech Program.

Government College of Engineering, Karad

Programme: Double Minors (Multidisciplinary and Specialization Minors)

EXDO-0301: Electronic Circuits

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Semiconductor physics, P-N Junction Diode

Course Outcomes (CO): Students will be able to

CO1	Identify and differentiate between various special purpose diodes and bipolar junction transistors (BJTs), including their structures, working principles, and applications.
CO2	Analyze and evaluate different biasing configurations and stabilization techniques used in transistor circuits.
CO3	Apply and demonstrate graphical analysis techniques for various FET configurations.
CO4	Create small-signal models for various biasing configurations and transistor typesand Analyze transistor amplifiers using h parameters

	Course Contents	CO	Hours
Unit 1	**Diodes and BJT:** Structure, working and applications of Special purpose diodes (Schottky barrier, varactor diodes, Solar cells, photodiodes, LCDs and Tunnel diodes) BJT: Types, structure, operation and characteristics, CE, CB, and CC configurations of BBJT	**CO1**	**4**
Unit 2	**Transistor Biasing:** Operating Point, concept of a.c and d.c load lines, Need for Bias Stabilization, Biasing Configurations: Fixed Bias, Collector-to-Base Bias, Bias Circuit with Emitter Resistor, Voltage Divider Biasing, Emitter Bias, Bias Stability, Stability Factor.	**CO2**	**4**
Unit 3	**Low frequency analysis of Transistor:** Graphical analysis of the CE configuration. Two port devices and the Hybrid Model, Transistor Hybrid Model, h parameters, Analysis of transistor amplifier using h Parameters, Emitter follower.	**CO4**	**5**
Unit 4	**Transistor at High frequency:** Hybrid -π CE Transistor model, Hybrid -π conductance, Hybrid -π capacitance, Validity of Hybrid -π model, variation of Hybrid -π parameters, CE short circuit current gain	**CO4**	**4**
Unit 5	**Field Effect Transistor:** Structure types and working of FET and MOSFET. CS, CG and CD configurations of FET, Fixed-Bias Configuration, Self-Bias Configuration, Voltage-Divider Biasing, Common-Gate Configuration	**CO3**	**5**
Unit 6	**FET Amplifiers:** JFET Small-Signal Model for Fixed-Bias Configuration, Self-Bias Configuration, Voltage-Divider Biasing, Common-Gate Configuration, Source-Follower (Common-Drain) Configuration	**CO2**	**5**

Text Books

1. "Electronic devices and circuit theory" - Robert L. Boylestad, Louis Nashelsky, 11th edition, 2015
2. J. Millman & C. Halkias, "Electronic devices & circuits", Tata McGraw Hill Publication. 3rd Edition, 2007

Reference Books

1. "Electronic Circuit Analysis and Design" , Donald A. Neamen, Tata McGraw Hill, 2nd Edition, 2002
2. "Electronic devices" Thomas L. Floyd. —Pearson Education 9th edition 2012
3. "Electronic Devices and Circuits" by David A. Bell, OXFORD, 5th Edition, 2008

Useful Links

1. https://archive.nptel.ac.in/courses/108/108/108108112/ Semiconductor devices and circuits/ Prof. Sanjiv Sambandan, IISc Bangalore.

2.	https://archive.nptel.ac.in/courses/108/102/108102095/ Analog Electronics circuits/ Prof. S. C. Dutta Roy IIT Delhi

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 6	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	1	3	-	2	-	-	-	-	-	-	-	-	2	-
CO 2	-	3	2	-	1	-	-	-	-	-	-	-	1	-	-
CO 3	1	3	3	-	2	1	-	-	-	-	-	-	2	-	-
CO 4	1	3	2	-	1	-	-	-	-	-	-	-	2	-	-

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	-
Understand	5	5	25
Apply	5	5	20
Analyse	5	5	15
Evaluate	-	-	-
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

Programme: Double Minors (Multidisciplinary and Specialization Minors)

EXDO-0401:Digital Electronics

Teaching Scheme			Examination Scheme	
Lectures	02Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Basic Electronics, Mathematics.

Course Outcomes (CO): Students will be able to

CO1	Understand Basic Digital Logic and Boolean Concepts.
CO2	Analyze, design and implement combinational circuits.
CO3	Analyze, design and implement sequential circuits.
CO4	Design basic electronics circuits for various applications

	Course Contents	CO	Hours
Unit 1	**Number Systems:** Number System (Binary, Decimal, Octal and Hexadecimal), Number Base Conversion, Arithmetic operation, Complements of Number.	**CO1**	**(05)**
Unit 2	**Boolean Algebra and logic gates** Basic Definition, logic operation, Axioms and laws of Boolean Algebra, De Morgan's Theorem, Reducing Boolean Expression, Digital logic gates.	**CO1**	**(04)**
Unit 3	**Simplification of Boolean Functions:** Introduction, The Map method, Two, Three and Four-Variable K-Map, Product of Sum and Sum of Product, NAND and NOR implementation, Don't-Care conditions.	**CO1**	**(05)**
Unit 4	**Combinational Logic:** Introduction, Half Adder, Full Adder, Half Subtractor, Full Subtractor, Multiplexer, De Multiplexer, Encoder and Decoder.	**CO2**	**(04)**
Unit 5	**Sequential Logic:** Introduction, Difference between Sequential and Combinational, Latches, Flip Flops: RS, JK, T and D, Triggering of flip flops, Operating Characteristic of FF, Excitation table and Equation.	**CO3**	**(05)**
Unit 6	**Registers and Counters:** Registers: SISO, SIPO, PISO, PIPO, Universal Shift Register Counters: Asynchronous and Synchronous Counter with state transition diagram, Up/Down, Application of Sequential Circuit: Ring Counter, Johnson Counter.	**CO4**	**(05)**
	Note:ISE will be conducted on the basis of understanding, design assignment and presentation on the following topics which will be studied by students themselves. Code Converters (binary-grey & grey-binary, Magnitude Comparator, Conversion of Flip Flops, MOD N counter, Customizable Digital Circuits.		

Text Books

1. A. Anand Kumar, "Fundamentals of digital circuits", PHI publication, 1st edition, 2001.
2. R.P. Jain, "Modern Digital Electronics", Tata McGraw - Hill Education, 4th edition, 2010.

Reference Books

1. Anil K. Maini, "Digital Electronics principles and Integrated Circuits", Wiley Publications. 1st edition, 2007.
2. Donald P. Leach / Albert Paul Melvino/Gautam Saha, "Digital Principles and Applications", The McGraw Hill, Eight Edition (2015).
3. Stephen Brown & Zvonko Vranesic, "Fundamentals of Digital Logic Design with VHDL", Second Edition, TMH (2009).

Useful Links			
1.	https://onlinecourses.nptel.ac.in/noc21_ee39/preview, Prof. Neeraj Goel IIT Ropar		
2.	https://nptel.ac.in/courses/117105080, Prof. D. Roy Choudhury IIT Kharagpur		

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	-	-	-	-	1	1	-	1	1	1	2
CO 2	2	2	2	2	3	-	-	-	-	-	-	2	2	2	3
CO 3	3	3	3	3	3	-	-	-	1	2	-	-	2	2	2
CO 4	2	2	3	-	3	-	-	-	1	-	-	-	2	2	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	5	5	20
Apply	5	5	10
Analyse	5	5	20
Evaluate	-	-	-
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad				
Programme: Honors and Multidisciplinary Minor (Embedded Systems)				
EXHO-0401: System Design using Embedded Processor				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		FA	20
Tutorials	00 Hrs/week		SA	30
Total Credits	03			

Prerequisite : Knowledge of Digital electronics, Microcontroller Architecture and Programming

Course Outcomes (CO): Students will be able to

CO1	Understanding of Embedded Systems.
CO2	Ability to Design and Optimize ARM-based Systems
CO3	Apply knowledge of Cortex-M3 architecture in designing, developing, and debugging embedded systems applications,
CO4	Hands-on experience using various development and debugging tools,

	Course Contents	CO	Hours
Unit 1	**Embedded Concepts:** Introduction to embedded systems, Application Areas, Categories of embedded systems, Overview of embedded system architecture, Specialties of embedded systems, recent trends in embedded systems, Architecture of embedded systems, Hardware architecture, Software architecture, Application Software, Communication Software, Development and debugging Tools.	**CO1**	**(07)**
Unit 2	**ARM Architecture:** Background of ARM Architecture, Architecture Versions, Processor Naming, Instruction Set Development, Thumb-2 and Instruction Set Architecture.Parameters.	**CO2**	**(06)**
Unit 3	**Overview of Cortex-M4:** **Cortex-M4 Basics:** Registers, General Purpose Registers, Stack Pointer, Link Register, Program Counter, Special Registers, Operation Mode, Exceptions and Interrupts, Vector Tables, Stack Memory Operations, Reset Sequence. **Instruction Sets:** Assembly Basics, Instruction List, Instruction Descriptions. **Cortex-M4 Implementation Overview:** Pipeline, Block Diagram, Bus Interfaces on Cortex-M4, I-Code Bus, D-Code Bus, System Bus, External PPB and DAP Bus. **Exceptions:** Exception Types, Priority, Vector Tables, Interrupt Inputs and Pending Behavior, Fault Exceptions, Supervisor Call and Pendable Service Call. **NVIC:** Nested Vectored Interrupt Controller Overview, Basic Interrupt Configuration, Software Interrupts and SYSTICK Timer. **Interrupt Behavior:**Interrupt/Exception Sequences, Exception Exits, Nested Interrupts, Tail-Chaining Interrupts, Late Arrivals and Interrupt Latency	**CO3**	**(08)**
Unit 4	**Cortex-M4 Programming:** **Cortex-M4 Programming:** Overview, Typical Development Flow, Using C,CMSIS (Cortex Microcontroller Software Interface Standard), Using Assembly. **Exception Programming:** Using Interrupts, Exception/Interrupt Handlers, Software Interrupts, Vector Table Relocation. **Memory Protection Unit and other Cortex-M4 features:** MPU Registers, Setting p the MPU, Power Management**,** Multiprocessor Communication.	**CO3**	**(08)**
Unit 5	**Cortex-M4 Microcontroller:** **STM32L15xxx ARM Cortex M4 Microcontroller:** Memory and Bus Architecture, Power Control, Reset and Clock Control. **STM32L15xxx Peripherals:** GPIOs, System Configuration Controller, NVIC, ADC,	**CO4**	**(07)**

	Comparators, GP Timers, USART.		
Unit 6	**Development & Debugging Tools:** Software and Hardware tools like Cross Assembler, Compiler, Debugger, Simulator, In-Circuit Emulator (ICE), Logic Analyzer etc.	**CO4**	**(06)**

Text Books	
1.	Dr. K.V.K Prasad , "Embedded/Real Time Systems Concepts, Design and Programming Black Book", Dream Tech Press, New Edition - 1 January 2003.
2.	David Seal "ARM Architecture Reference Manual", Addison Wesley, England;Morgan Kaufmann Publishers, 2001
3.	Andrew N Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide -Designing and Optimizing System Software", Elsevier. 2006,
4.	The Definitive Guide to the ARM Cortex-M4, Joseph Yiu, ElsevierInc. Second Edition, 2010
Reference Books	
1.	Steve Furber, "ARM System-on-Chip Architecture", Pearson Education 2nd Edition, 2001
2.	Arnold. S. Berger, "Embedded Systems Design - An introduction to Processes, Tools and Techniques", Easwer Press, 2001.
3.	Cortex-M series-ARM Reference Manual, 2 Mar 2010
4.	ARM Company Ltd. "ARM Architecture Reference Manual– ARM DDI 0100E"
Useful Links	
1.	https://archive.nptel.ac.in/courses/106/105/106105193/ EMBEDDED SYSTEM DESIGN WITH ARM/PROF. INDRANIL SENGUPTA/IIT Kharagpur
2.	https://elearn.nptel.ac.in/shop/iit-workshops/completed/lab-workshop-on-embedded-c-and-arm-cortex-microcontrollers-2/

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	3	-	2	-	-	-	-	-	-	1	-	2	
CO 2	2	3	1	-	-	-	-	-	-	3	-	2	-	2	3
CO 3	3	2	3	-	-	-	-	-	2	-	-	2	-	2	3
CO 4	3	1	2	3	-	-	-	-	2	-	-	-	-	2	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	5	5	20
Apply	5	5	10
Analyse	5	5	20
Evaluate	-	-	-
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad				
Programme: Honors and Multidisciplinary Minor (Embedded Systems)				
EXHO-0402 :System Design using Embedded Processors Laboratory				
Laboratory Scheme:			**Examination Scheme:**	
Practical	02 Hrs/week		SA	50
Total Credits	01			
Prerequisite :				
Course Outcomes (CO): Students will be able to				
CO1	Develop the ability to write efficient and optimized assembly code to perform arithmetic operations, data manipulation, and control flow.			
CO2	Acquire practical skills in developing embedded systems applications using ARM Cortex-M microcontrollers.			
CO3	Understand various communication protocols such as polling and interrupt-driven methods for serial communication with peripherals.			
CO4	Learn principles and techniques for designing and implementing real-time data acquisition and control systems.			

Course Contents		**CO**
Implementation of following concepts		
Experiment 1	Write a program to add two 32- bit numbers stored in r0 and r1 registers and write the result to r2.	**CO1**
Experiment 2	Write a program to multiply two 16-bit numbers stored in r0 and r1 registers and write the result to r3. Put 0xFFFFFFFF and 0x80000000	**CO1**
Experiment 3	Write ARM assembly to perform function of division.Registers r1 and r2 contains the divident and divisor,r3 contains the quotient, and r5 contains the remainder.	**CO1**
Experiment 4	Write ARM assembly to perform following array assignment in C:for(i=0;i<=10;i++){a[i]=b[i]+c;}	**CO1**
Experiment 5	Write a program to toggle green LED (portB.6) and Blue LED (portB.7) on STM32L- Discovery by configuring GPIO and using software delay.	**CO2**
Experiment 6	Transmit a string “Programming with ARM Cortex” to PC by configuring the registers of USART3. Use polling method.	**CO2**
Experiment 7	Write a program to toggle the LEDs at the rate of 1 sec using standard peripheral.	**CO2**
Experiment 8	Transmit a data to PC by using standard peripherals with USART1. Use interrupts method.	**CO3**
Experiment 9	Receive a data sent by PC by using standard peripherals with USART1. Use interrupts method.	**CO3**
Experiment 10	Write a program to read the analog input connected to ADC and compare with threshold so as to control the digital output(LEDs) use standard peripherals.	**CO4**
Experiment 11	Design of a real-time data acquistion& control system using the STM32LxxARM CortexM4 Microcontroller.	**CO4**
List of Submission:		
	Minimum number of Experiments : 10	

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	1	-	-	1	-	-	-	-	-	-	2	2	-	2
CO 2	3	2	-	-	2	2	-	-	2	-	-	2	3	2	3
CO 3	3	2	3	2	3	-	-	-	1	-	-	3	-	2	3
CO 4	3	2	3	-	3	2	-	-	-	-	2	2	-	3	3

1: Slight(Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

Government College of Engineering, Karad				
Programme: Double Minors (Multidisciplinary and Specialization Minors)				
EXDO 0401 : Analog Communication				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		FA	20
Tutorials	00 Hrs/week		SA	30
Total Credits	03		TOTAL	50

Prerequisite : Signals and system, Mathematics.

Course Outcomes (CO): Students will be able to

CO1	Describe the various elements of communication system.
CO2	Analyze the performance of different analog modulation methods.
CO3	Illustrate generation and detection of amplitude and frequency modulated systems.
CO4	Characterize pulse modulation techniques.

	Course Contents	CO	Hours
Unit 1	**Elements of communication systems:** Information sources, communication channels, noise, sources of noises, need for modulation, bandwidth and power trade-off	**CO1**	**(08)**
Unit 2	**Amplitude Modulation and demodulation:** Amplitude Modulation: Types of Analog Modulation, Principles of Amplitude Modulation, AM for a Complex Modulating Signal, AM Power Distribution, AM Current Distribution, Limitations of AM, AM modulators and Demodulator. Types of AM: Modulation & Demodulation Techniques: DSB-SC, SSB-SC, Comparison of AM, DSBSC and SSB.	**CO2**	**(07)**
Unit 3	**Angle modulation and demodulation**: Frequency Modulation: Principles of Angle Modulation, Theory of FM— Basic Concepts, Spectrum Analysis of FM Wave, Narrowband and Wideband FM, Noise triangle, Pre-emphasis, de-emphasis FM Generation: Direct methods and Indirect method, FM Detection: Frequency discriminator and Phase discriminator methods. Phase Modulation: Theory of Phase Modulation, Relationship between FM and PM, Advantages and Disadvantages of Angle Modulation, Comparison of AM, FM and PM.	**CO3**	**(05)**
Unit 4	**Radio Transmitters and Receivers:** Radio receivers: Receiver Characteristics: Sensitivity, Selectivity, Fidelity, Image frequency rejection ratio, TRF Receivers and its characteristics, Concept of Heterodyning, Super heterodyne Receiver, choice of Intermediate frequency.AM and FM Transmitters and Receivers: AM and FM Radio Transmitters, AM and FM Radio Receivers, Practical diode detector, Automatic Gain Control (AGC), Types of AGC, Automatic Frequency Control (AFC) and Importance of Limiter	**CO4**	**(07)**
Unit 5	**Introduction to digital transmission of signals**: comparison of Digital Analog Transmissions, Concept of regenerative Repeater, Sampling and quantization: Sampling Theorem, Aliasing error, Natural Sampling, Flat top sampling, Quantization of Signals.	**C05**	**(06)**
Unit 6	**The Pulse-Modulation and Multiplexing:**. Pulse Modulation Techniques: Generation and detection of Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM). PCM and Multiplexing: Pulse-Code Modulation (PCM), Significance of Companding for voice signals,	**C06**	**(07)**

	Delta Modulation, Time Division Multiplexing (TDM) and Frequency Division Multiplexing (FDM) T		

Text Books	
1.	Kennedy and Davis, "Electronics Communication System", Tata McGrawHill, 5th Edition, 2023.
2.	Simon Haykins& Moher, Communication Systems, John Wiley, India Pvt. Ltd, 5th Edition, 2010
3.	John. G. Proakis, Masoud Salehi, "Fundamentals of Communication Systems", Pearson Education, 6th edition 2011.
Reference Books	
1.	B P Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, Oxford University Press., 4th edition, 2010,
2.	Simon Haykins, An Introduction to Analog and Digital Communication, John Wiley India Pvt. Ltd.,2008
3.	H Taub & D L Schilling, Principles of Communication Systems, TMH, 3rd edition 2011.
Useful Links	
1.	https://youtu.be/iZM2zgxnEOc/Prof. Goutam Das/ DIGITAL COMUNICATION/IIT, Kharagpur

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 6	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
CO 1	2	2	1	-	2	-	-	-	-	-	1	-	1	3	-
CO 2	2	3	2	1	1	1	-	-	-	-	-	1	1	3	1
CO 3	3	2	2	2	-	1	-	-	-	-	1	1	1	3	1
CO 4	3	2	2	2	-	-	-	-	-	-	-	1		3	
CO5	2	3	2	1	1	1	-	-	-	-	-	1	1	3	1
CO6	2	2	1	-	2	-	-	-	-	-	1	-	1	3	

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	FA	SA
Remember	3	
Understand	5	10
Apply	6	10
Analyse	6	5
Evaluate		5
Create	-	-
TOTAL	20	30

Government College of Engineering, Karad					
Programme: Double Minors (Multidisciplinary and Specialization Minors)					
EXDO 0402: Analog Communication Lab					
Laboratory Scheme:			**Examination Scheme:**		
Practical	02 Hrs/week				
Total Credits	01				
Prerequisite : Computer fundamentals					
Course Outcomes (CO): Students will be able to					
CO1	Model an analog communication system signal transmission and reception.				
CO2	Realize the electronic circuits to perform analog and pulse modulations and demodulations.				
CO3	Verify the sampling theorem and relate the signal and its spectrum before and after sampling.				
CO4	Understand the process of PCM and delta modulations.				
Course Contents					**CO**
Implementation of following concepts					
Experiment 1	Amplitude Modulation and Demodulation of (a) Standard AM and (b) DSBSC .				**CO1**
Experiment 2	Spectrum Analysis Of Modulated Signal Using Spectrum Analyzer				**CO1**
Experiment 3	Frequency modulation and demodulation				**CO2**
Experiment 4	Design and test Time Division Multiplexing and Demultiplexing of two band limited signals.				**CO2**
Experiment 5	To perform and analyze different blocks in AM super heterodyne receiver				**CO2**
Experiment 6	To perform and analyze pre emphasis and de-emphasis.				**CO2**
Experiment 7	Design and test i) Pulse sampsling, flat top sampling and reconstruction. ii)Pulse amplitude modulation and demodulation.				**CO3**
Experiment 8	Pulse Width Modulation and Pulse Position Modulation				**CO3**
Experiment 9	Pulse Code Modulation and demodulation				**CO4**
Experiment 10	Delta Modulation and Adaptive Delta Modulation				**CO4**
List of Submission:					
	Minimum number of Experiments : 10				

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
CO 1	2	2	2	2	-	2	-	-	-	-	-	-	1	3	1
CO 2	2	3	2	2	2	2		-	-	-	-	-	1	3	1
CO 3	2	2	3	2	2		-	-	-	-	-	-	1	3	1
CO 4	2	3	2	2	2	2		-	-	-	-	-	1	3	1
CO 5	2	2	2	2	-	2							1	3	1

1: Slight(Low) 2: Moderate (Medium) 3: Substantial (High)