(EL405) ELECTRICAL & ELECTRONICS WORKSHOP

1. COURSE OBJECTIVES

The course content will enable the students to learn symbols used for various electrical appliances, making wire joints, crimping of lugs, coil winding and to develop hand on skill for domestic wiring works, estimation of bill of materials and repairs & maintenance of various domestic appliances

2. TEACHING AND EXAMINATION SCHEME

Semester **III**									
Course code & course title	**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**				
					Theory Marks		**Practical Marks**		**Total Marks**
(EL405) Electrical & Electronics Workshop	**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	75
	-	-	4	4	-	-	50	25(O)	

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:
EL405.CO1: Demonstrate the use of series test lamp, multimeter, MCB, MCCB, ELCB and crimping tool.
EL405.CO2: Choose appropriate tools and equipments and apply the skills for carrying out repair and maintenance works of domestic appliances.
EL405.CO3: Prepare plan for domestic wiring works and estimate the material required for the same.
EL405.CO4: Design and develop a mini project and fabricate the PCB required for the same

4. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
EL405.CO1	3	2	1	3	1	3	2
EL405.CO2	3	2	1	3	1	3	3
EL405.CO3	3	3	3	3	2	3	3
EL405.CO4	3	3	3	3	2	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
EL405.CO1	3	3
EL405.CO2	3	3
EL405.CO3	3	3
EL405.CO4	3	3

5. SPECIFICATION TABLE FOR TERM WORK
(Any 3 from first 5 experiments, experiments 6 to 10 are compulsory)

No	Practical	Marks
1.	Check fault in the electrical components/circuits using series test lamp, multimeter and meggar.	
2.	Practice of coil winding	
3.	Practicing of crimping different types of lugs	
4.	Study of MCB, MCCB, ELCB	
5.	Electrical maintenance of Air conditioner and Refrigerator	
6.	Connection of fluorescent tube light circuit, identifying its components and measuring of operating and conducting voltage	
7.	Planning, estimating material and connecting given circuit for small room wiring	
8.	Repair and maintenance of domestic appliances (Electrical) such as iron, ceiling fan, table fan, mixer, hot plate, oven, electric kettle, etc. (Minimum 4)	
9.	Repair and maintenance of domestic appliances (Electronics) such as stabiliser, washing machine, television, music stereo, CPU, power supply unit, etc. (Minimum 3)	
10.	Mini project on PCB making.	
	Total	50

6. LEARNING RESOURCES
Text Books

S. No.	Author	Title of Books	Publishers
1	K. B. Bhatia	Electrical appliances & devices	Khanna publishers

(EL408) POWER GENERATION TRANSMISSION & DISTRIBUTION

1. COURSE OBJECTIVES

The course content will enable the students to learn different energy sources & electrical power generation, transmission & distribution process and to be conversant with different domestic wiring system and earthing

2. TEACHING AND EXAMINATION SCHEME

Semester	**IV**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
Power Generation Transmission & Distribution (EL408)		**L**	**T**	**P**	**H**	**TH**	**TM**	**TW**	**PR/OR**	
		3	-	-	3	75	25	-	-	**100**

3. COURSE OUTCOMES:

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

EL408.CO1: Explain different aspects related to generation, transmission and distribution systems and list components with their functions.

EL408.CO2: Illustrate with sketch the layouts and line diagram of generation processes, types of transmission and distribution lines, domestic wiring and earthing systems.

EL408.CO3: Compare different types of power generation, transmission and distribution systems.

EL408.CO4: Compute parameters related to generation and transmission and prepare estimate for domestic wiring works.

4. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
EL408.CO1	3	1	1	1	1	2	2
EL408.CO2	3	1	1	1	2	2	2
EL408.CO3	3	3	3	2	2	3	2
EL408.CO4	3	3	3	3	3	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
EL408.CO1	2	2
EL408.CO2	3	2
EL408.CO3	2	3
EL408.CO4	2	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
1. GENERATION	**15**	**10**	**CO1, CO2 CO3, CO4**
1.1 Terms related to generation: Load curve, demand factor, diversity factor load factor, utilization factor (Simple numerical). Concept of Base load & peak load power plant Grid System, its merits & demerits			
1.2 Main sources of energy for bulk power generation (Thermal, Hydro & nuclear), principle of generation using these sources, plant layout & its components. Non conventional energy sources: Concept of solar photovoltaic power generation with Schematic diagram. Basic Block diagram and working of wind power generation			
1.3 Diesel generator sets; its main components & their functions. Advantages & disadvantages of diesel power plant			
2. **TRANSMISSION**	**24**	**18**	**CO1, CO2 CO3, CO4**
2.1 Components of Transmission lines, Types of supports (poles: MS rail & RCC, towers) Types of conductors: AAC, ACSR, All aluminium alloy conductor, bundled conductor, ABC & their general electrical & mechanical properties. Insulators: Pin type, Disc type, post type, stay insulator Comparison between pin type & suspension insulators. Causes of failure of insulators. Concept & calculation of Voltage distribution & string efficiency, methods of improving string efficiency, General specifications of insulators.			
2.2 Resistance, inductance & capacitance of transmission lines (No derivation, No numerical). Classification of transmission lines as short, medium & long lines. Concept of transposition of conductors Concept of Skin effect. Corona: Its formation, advantages & disadvantages. Method of its reduction. Sag & its importance (No numerical)			
2.3 HV, EHV & HVDC transmission system, their main components. Advantages & disadvantages of each system.			
3. **DISTRIBUTION SYSTEMS**	**15**	**9**	**CO1, CO2, CO3**
3.1 Classification of distribution system w. r. t. Voltage & number of wires as DC 2 wire, AC 2 wire (single phase), AC 3 wire & AC 4 wire system. Their comparison with respect to Volume of conductor material for each type and other factors,			

Comparison between overhead system and underground system. Comparison between single phase & three phase, Three phase three wire & three phase four wire			
3.2 Concept of feeder, distributor & service mains Types of distributor: Radial, ring & interconnected System			
4. **DOMESTIC WIRING**	**12**	**7**	**CO1, CO2 CO3, CO4**
4.1 Standard practices relevant to light & fan, power wiring Types of wiring:- Casing & capping, conduit (PVC, metallic & concealed), their advantages & disadvantages Important materials used for house wiring & their functions (main switch, distribution board, switch, ceiling rose, lamp holder & socket) Schematic & wiring diagram for simple circuits including staircase & godown wiring			
4.2 Planning & layout of a domestic installation Estimation of quantity/bill of material required for a given domestic installation			
5. EARTHING	**9**	**4**	**CO1, CO2, CO3**
5.1 Purpose/significance of earthing, Standard earthing practices.			
5.2 Methods & procedure of earthing: Pipe & plate Factors affecting earth resistance, methods of reducing earth resistance			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	GENERATION	10	15
2	TRANSMISSION	18	24
3	DISTRIBUTION SYSTEMS	9	15
4	DOMESTIC WIRING	7	12
5	EARTHING	4	9
	Total	48	75

8. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	V.K. Mehta	Principle of Power System	S. Chand
2	J. B. Gupta	A course in Electric Power	S.K. Kataria & Sons
3	Dr. S. L. Uppal	Electrical Power	Khanna Publishers
4	J. B. Gupta	Electrical Installation Estimation & Costing	S.K. Kataria & Sons

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Raina, Anand & Singhal	Transmission & Distribution of Electrical Energy	
2	Arora B D	Electric Wiring Estimation & Costing	R. B. Publications
3	Raina & Bhattacharya	Electrical Design Estimation & Costing	New Age International Publishers

Indian and International codes needed

S. No.	Author	Title of Books	Publishers
1	Government of India Ministry of power central electricity board	THE INDIAN ELECTRICITY RULES, 1956	

(EL305) ELECTRICAL DRAWING USING CAD

1. COURSE OBJECTIVES

This course will enable the students to use key features of CAD for professional electrical design and drafting.

2. TEACHING AND EXAMINATION SCHEME

Semester	**IV**									
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**				
						Theory Marks		**Practical Marks**		**Total Marks**
(EL 305) Electrical Drawing using CAD		L	T	P	H	TH	TM	TW	PR/OR	
		-	-	4	4	-	-	50	50(P)	100

3. COURSE OUTCOMES:

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

EL305.CO1: Choose appropriate commands to develop various electrical drawings using CAD.
EL305.CO2: Demonstrate use of CAD for electrical and electronics circuit drawing.
EL305.CO3: Make use of CAD and drawing skills to prepare wiring layouts and wiring diagram.
EL305.CO4: Develop drawing for electrical equipment.

4. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation& Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
EL305.CO1	1	1	-	3	-	1	3
EL305.CO2	2	1	-	3	-	2	3
EL305.CO3	2	2	2	3	2	2	3
EL305.CO4	2	2	2	3	1	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
EL305.CO1	2	2
EL305.CO2	2	2
EL305.CO3	2	2
EL305.CO4	2	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**

Unit	**M**	**Thr**	**CO**
1**. INTRODUCTION TO CAD PRELIMINARIES AND HANDS ON PRACTICE OF COMMANDS**.		**14**	**CO1**
1.1. Setting up new drawing: Units, Limits, Grid, Snap			
1.2. Drawing basic objects: Point, Line, Circle, Arc, Ellipse, Parabolas, polygon, Rectangle, Multiline, drawing with precision, drawing construction lines and rays, calculating distance and angle, use of measure, divide, inquiry commands, redraws and regenerating screen display. Using Object snap: Endpoint, midpoint, Intersection, Centre Point, Quadrant point, Nearest Perpendicular, Apparent Intersection, etc.			
1.3. Edit/modify features and viewing drawings: Object selection: selection set with its options like pick box, window, crossing, previous, last drawing etc. Editing commands – zoom all, zoom previous, zoom extents, zoom window, zoom real time, zoom dynamic, zoom pan Modify commands: erase, copy, mirror, offset, array, move, scale, stretch, lengthen, trim, extend, rotate, break, join, chamfer, fillet,			
1.4. Organising Drawing: concept of layers: creating layers, naming layers, making layers ON/OFF, freeze thaw layers, lock/unlock layers, setting the properties of layers like colour, line type, line weight. Concept of blocks: creating, inserting, redefining, and exploding blocks. Concept of hatch: selecting hatch pattern, hatch styles, hatch orientation, associative hatch, boundary hatch, hatching object.			
1.5 Dimensioning and Tolerance: Dimensioning and editing dimensions. Single line text, multiline text.			
1.6 Printing/ Plotting drawing: Standard sizes of sheet. Selecting various plotting parameters such as paper size, paper units, drawing orientation, plot scale, plot offset, plot area, print preview.			
2. DRAWING OF SYMBOLS FOR BASIC ELECTRICAL, ELECTRONICS AND SUBSTATION EQUIPMENT.		**08**	**CO1** **CO2** **CO3** **CO4**
3. i) DRAWING OF COMPONENTS OF ELECTRICAL MACHINES AND DIFFERENT TYPES OF STARTERS. Different parts of transformers, AC and DC motors and their starting methods **ii) DRAWING OF SIMPLE BASIC ELECTRONIC CIRCUITS.** Basic rectifier circuit, transistor biasing circuit.		**16**	**CO1** **CO2** **CO4** **CO3**
4 i) DRAWING OF ELECTRICAL POWER SYSTEM COMPONENTS Transmission and distribution line components, pole mounted		**14**	**CO1** **CO2** **CO3**

substation and single line diagrams **ii) DRAWING OF ELECTRIC CIRCUIT DIAGRAM FOR REFRIGERATOR, WINDOW AC, SPLIT AC, OVEN, HPMV LAMP, HPSV LAMP.**			**CO4**
5. **DOMESTIC AND INDUSTRIAL INSTALLATION WIRING**		**12**	**CO1** **CO2** **CO3**
5.1 Wiring diagrams for domestic installation.			
5.2 Wiring diagram for installation of 3 phase induction motor			
Total		**64**	

6. COURSE DELIVERY:

The Course will be delivered through practicals, laboratory interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of hours**
1	INTRODUCTION TO CAD PRELIMINARIES AND HANDS ON PRACTICE OF COMMANDS	14
2	DRAWING OF SYMBOLS FOR BASIC ELECTRICAL, ELECTRONICS AND SUBSTATION EQUIPMENT	08
3	DRAWING OF COMPONENTS OF ELECTRICAL MACHINES AND DIFFERENT TYPES OF STARTERS . AND DRAWING OF SIMPLE BASIC ELECTRONIC CIRCUIT	16
4	DRAWING OF ELECTRICAL POWER SYSTEM COMPONENTS AND DRAWING OF ELECTRIC CIRCUIT DIAGRAM FOR REFRIGERATOR, WINDOW AC,SPLIT AC, OVEN, HPMV LAMP, HPSV LAMP.	14
5	DOMESTIC AND INDUSTRIAL INSTALLATION WIRING	12
	Total	64

8. SPECIFICATION TABLE FOR TERM WORK

Term Work shall consists of minimum 6 No's of Electrical Drawing Sheets using CAD and minimum two on full imperial drawing sheets (or 4 half imperial)

Sr No	**Drawing sheet details**	**Marks**
1	Basic electrical, electronics and substation equipment symbols.	
2	Transformer Details : core, winding , tank & other accessories	
3	Components of DC motor	
4	Three phase squirrel cage and slip ring induction motor and their parts.	
5	Dc and AC Motor Starters (4-point starter, DOL starter, Star Delta Starter { Manual & Automatic},Autotransformer starter, rotor resistance starter)	
6	Transmission and distribution line components	
7	Layout of 11 KV/0.4 KV H pole mounted substation.	
8	Single line diagram of Extra High Voltage (220KV or 110 KV)substation	
9	Drawing of wiring diagram for domestic installation	

10	Drawing of wiring diagram for 3 phase induction motor	
11	Drawing basic rectifier circuits	
12	Drawing transistor biasing circuits	
13	Drawing electrical wiring diagram for refrigerator, window AC, split AC, Oven, HPMV lamp, HPSV lamp.	
	Total	50

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	P. Nageshwar Rao	AutoCAD for Engineering drawing made easy	Tata McGraw Hill.
2	George Omura	Mastering AutoCAD	BPB Publication
4	Raina ,Bhattacharya	Electrical design ,Estimating and costing	New Age International
5.	P. S. Bhimbra	Power Electronics	Khanna Publisher
6.	V. K. Mehta, Rohit Mehta	Principles of Electronics	S. Chand

(EL401) ELECTRICAL MACHINES II

1. COURSE OBJECTIVES:

This subject enables the student to understand the working principle, construction, performance & characteristics, control and applications of various AC electrical machines such as Induction motor (single phase & three phase), alternator, synchronous motor and other AC motors. The students would get acquainted with the knowledge regarding analyzing the various parameters of these machines and also get familiarized with the various starting methods & starters used for starting of these machines along with their control circuits

2. TEACHING AND EXAMINATION SCHEME

Semester	**IV**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(EL401) Electrical Machines II		L	T	P	H	TH	TM	TW	PR/OR	
		4	-	2	6	75	25	25	25(P)	150

3. COURSE OUTCOMES:

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

EL401.CO1: Explain principle of operation and construction of A.C. Machines
EL401.CO2: Demonstrate parallel operation of Alternators and various methods of starting, speed control of A.C. Motors.
EL401.CO3: Compare different types of A.C. machines and their starters
EL401.CO4: Evaluate voltage regulation and efficiency of A.C. machines

4. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation& Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
EL401.CO1	2	-	-	-	-	3	2
EL401.CO2	3	3	2	3	2	3	3
EL401.CO3	2	2	-	-	-	3	3
EL401.CO4	3	3	2	3	3	3	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
EL401.CO1	2	3
EL401.CO2	3	3
EL401.CO3	2	3
EL401.CO4	3	3

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
1 CONSTRUCTION AND PERFORMANCE OF INDUCTION MOTOR	**21**	**18**	**CO1, CO3, CO4**
1.1 Fundamental principles of rotating machines: Production of rotating magnetic flux in a 3 phase winding using vector method, working principle of 3 phase Induction motor Constructional details and its types: List and functions of parts (stator core, stator winding, rotor for slip ring and squirrel cage) Terminal marking for three phase induction motor. Concept of slip, rotor frequency, rotor emf, rotor current under standstill and running condition.			
1.2 Phasor diagram at full load condition. Development of Equivalent circuit diagram.(no numerical) Power flow diagram and calculation of efficiency in induction motor Torque-slip characteristics of induction motor and effect of change in rotor resistance on characteristics. Definitions of pull up & pull out torque. Relationship between starting torque and full load torque, starting torque and maximum torque.(no derivation)			
2 INDUCTION MOTOR STARTERS	**09**	**06**	**CO 2, CO3**
2.1 Necessity of starters Concept and operation of: Direct on line starter (Power & control circuit) Manual star/delta starter, Manual auto transformer starter, Rotor resistance starters for slip ring induction motor (Power circuit only). Concept of soft starter and its advantages.			
3 ALTERNATORS	**24**	**23**	**CO1, CO2, CO3, CO4**
3.1 Construction and working of alternator Comparison of salient and cylindrical pole type Advantages of stationary armature & rotating magnetic field.			
3.2 concept of full pitched coil, fractional pitched coil, emf equation (no derivation). Coil span factor and coil distribution factor (no derivation), effects of these factors on generated emf Frequency of induced emf and factors on which it depends. Operation of alternator under no load & on load (with phasor diagram) Armature reaction in a three phase alternator (with vector diagram only) and effects of load power factor on it.			
3.3 Operating parameters –armature resistance, leakage reactance, synchronous reactance and synchronous impedance. calculation of synchronous impedance by O.C. and S.C. test Definition, importance and calculation of Voltage regulation(no derivation) Operating characteristics of alternator Specifications for procurement.			
3.4 Necessity & desirable conditions for parallel operation of alternators, brief explanation of synchronizing alternators by (2 bright-1 dark lamp method and Synchroscope method)			
4 SYNCHRONOUS MOTOR	**09**	**05**	**CO1, CO2**
4.1 Principle of operation, methods of starting and Applications .			

Definition of load angle. Final Torque and power equations of a synchronous motor, Variation of currents and power factor under variable excitation & constant load (V-curve). Concept of synchronous condenser. Hunting and use of Damper windings			
5 SINGLE PHASE MOTORS	**12**	**12**	**CO 1, CO2, CO3**
5.1 Single Phase Induction Motors: Construction and classification, torque-speed characteristics (Double revolving field theory) Connection Diagram , working, application of: Capacitor start, capacitor start and run, permanent capacitor and shaded pole			
5.2 Universal motor, repulsion motor, stepper motor, servo motor			
Total	**75**	**64**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	CONSTRUCTION AND PERFORMANCE OF INDUCTION MOTOR	18	21
2	INDUCTION MOTOR STARTERS	06	09
3	ALTERNATORS	23	24
4	SYNCHRONOUS MOTOR	05	09
5	SINGLE PHASE MOTORS	12	12
	Total	64	75

8. SPECIFICATION TABLE FOR TERM WORK

No	Practical (Minimum 8)	Marks
1.	To perform no load & blocked rotor test on a 3 phase induction motor and: a) Determine its equivalent circuit parameters, total losses & efficiency, b) Plot the circle diagram to determine the total losses & efficiency.	
2.	To perform load test on a 3 phase induction motor and determine efficiency and variation of speed, power factor with the load.	
3.	Identification of parts and their functions in the following starters and their specifications:- DOL , autotransformer, star delta, rotor rheostat starters	
4.	Starting & reversal of direction of rotation of a 3 phase &1 phase induction motor.	
5.	To perform no load & blocked rotor test on a 1 phase induction motor and determine its efficiency.	
6.	To perform O.C & S.C test on an alternator and determine its synchronous impedance and voltage regulation.	
7.	To determine the excitation required to maintain constant voltage in an alternator under varying voltages	
8.	To plot “V curves” for a synchronous motor.	

9.	To perform the parallel operation of alternators.	
10.	To study the performance of special motors w. r. t current drawn, power consumed, sparking at the brushes and noise level.	
11.	Field visit.	
	Total	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	S.K. Bhattacharya	Electrical machinery	Tata Mcgraw
2	J. B. Gupta.	Theory & performance of Electrical Machines	S. K. Kataria & sons
3	B. L. Theraja.	Electrical Technology (Vol II)	S Chand
4	P.S. Bhimbra.	Elementary theory of electrical machines	Khanna Publishers

(EL402) APPLIED AND INTEGRATED ELECTRONICS

1. COURSE OBJECTIVES

This course includes study of electronic devices and circuits like rectifiers, regulators, amplifiers, oscillators and basics of integrated electronics. An understanding of these will provide a good platform to the students to enter into more complex and specialized fields of Electrical and Electronics Engineering.

2. TEACHING AND EXAMINATION SCHEME

Semester **IV**									
Course code & course title	**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**				
					Theory Marks		**Practical Marks**		**Total Marks**
(EL402) Applied And Integrated Electronics	L	T	P	H	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	25(O)	150

3.COURSE OUTCOMES:

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

EL402.CO1: Illustrate the operation and characteristics of semiconductor devices.
EL402.CO2: Explain applications of integrated circuits.
EL402.CO3: Demonstrate the working of various Electronic circuits.
EL402.CO4: Discuss the applications of semiconductor devices.

4. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Tools, Engg. Experimentation& Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
EL402.CO1	3	2	-	3	-	3	1
EL402.CO2	3	3	2	3	3	3	3
EL402.CO3	3	3	2	3	3	3	3
EL402.CO4	3	3	-	3	-	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
EL402.CO1	2	1
EL402.CO2	2	2
EL402.CO3	3	3
EL402.CO4	2	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
1. DIODES	**12**	**7**	**CO1, CO3, CO4**
1.1 PN Junction diode Construction, Symbol, PN junction with Forward and Reverse bias and V-I characteristics. PN junction diode as a Rectifier-Half wave Rectifier, Full Wave Rectifier, Bridge Type Rectifier. (Circuit diagram, operation and relevant waveforms)			
1.2 Zener Diode Concept of Zener breakdown, Construction of Zener diode, Symbol, VI Characteristics, List its various Applications. Zener Diode as a voltage Regulator (Circuit Diagram and Operation) Photodiode -Principle of Operation, symbol, characteristics ad Applications. Light Emitting Diode-Principle of Operation, symbol, characteristics and Applications			
2. TRANSISTORS	**15**	**11**	**CO1, CO3, CO4**
2.1 BJT Basic Construction, Terminals, BJT types -NPN and PNP, Transistor action and working of NPN and PNP. Transistor current components, Current amplification Factors, Relation between α and ß. Basic Configurations- CB,CE,CC-Input and Output characteristics of each, concept of Active region, Saturation region and cut off region in each case, comparison between CB, CE, CC.			
2.2 Transistor Biasing and Applications Need for biasing, Transistor Load lines- DC and AC Load Line, Q-point and its selection Criterion, Fixed Bias, Emitter Stabilized Bias and Voltage Divider Bias (Circuit Diagram, output Characteristics with load line points, Expression for input current, output current and output voltage in each case) , Merits, Demerits of each Biasing network. Applications of Transistor: Operation of Transistor as a switch and Operation of Transistor Amplifier.			
3. AMPLIFIERS AND OSCILLATORS	**18**	**13**	**CO3, CO4**
3.1 Small Signal Amplifier Concept of Zi, Zo, Av and Ai, Single Stage CE Amplifier (circuit, working, Frequency response)			

Concept of Multistage Amplifiers-Methods of Coupling-RC, Direct, Transformer Coupling (difference between them.) Two Stage RC coupled amplifier and Two stage Direct Coupled Amplifier (circuit diagram and Frequency response)			
3.2 Power Amplifier Concept of Power amplifiers & Classification (Class A,B,C) Transformer Coupled Class A Power Amplifier, Class B Push Pull Power Amplifier and Class C Power Amplifier.(No Derivation).			
3.3 Oscillators Concept of Positive feedback, Barkhausen's Criterion. RC Oscillator-Circuit and Operation of RC Phase Shift oscillator, Expression for Frequency. LC Oscillator- Concept of tank circuit- Circuit and Operation of Tuned Collector Oscillator Limitations of LC and RC Oscillators Crystal Oscillator- Circuit and Operation, Expression for Frequency.			
4. OPERATIONAL AMPLIFIER	**15**	**9**	**CO2**
4.1 Introduction- Concept of Differential Amplifier, Different modes of Operation- DIBO, DIUO. Block Diagram and working of Op Amp, Schematic diagram, Equivalent Circuit, Symbol and Pin Configuration of IC741. Opamp parameters Input Offset Voltage, Output Offset Voltage, Input Offset Current, Input Bias Current, CMRR, Slew Rate (Only definitions and typical values), Characteristics of Ideal and Practical Opamp, Concept of virtual ground.			
4.2 Modes of Operation of Opamp Inverting and Non inverting mode (circuit diagram, analysis and Operation), Voltage follower circuit and its applications.			
UNIT 5- APPLICATIONS OF OPAMP	**15**	**8**	**CO2, CO3**
5.1 Op-amp as a adder, subtractor (Circuit diagram, analysis, output expression) Op-amp as Zero Crossing Detector and Schmitt Trigger (No derivation, Only circuit diagram, operation and relevant Waveforms.) Op-amp as an Integrator and Differentiator. (Circuit diagram, analysis, output expression.)			
5.2 Introduction to IC 555-Block Diagram-construction and operation, Pin Configuration Applications- Astable , monostable multivibrator.			
TOTAL	75	48	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	DIODES	7	12
2	TRANSISTORS	11	15
3	AMPLIFIERS AND OSCILLATORS	13	18
4	OPERATIONAL AMPLIFIER	9	15
5	APPLICATIONS OF OP-AMPS	8	15
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK

No	**Practical** (Minimum 8)	Marks
1.	To verify the working of a PN junction diode as a Half wave Rectifier.	
2.	To verify the working of a PN junction diode as a Full Wave Rectifier.	
3.	To verify the working of a Zener Diode as a voltage regulator for change in supply voltage and load.	
4	To plot Input and Output Characteristic of CE amplifier	
5	To verify Q point parameters for a Fixed Bias circuit	
6.	To verify Q point parameters for a Voltage divider Bias circuit.	
7.	To plot frequency Response curve for a single stage RC coupled amplifier.	
8.	To study the operation of RC Phase shift Oscillator and to verify the frequency of oscillation.	
9.	To verify the working of Opamp in Inverting and Non inverting Mode	
10.	To verify the working of Opamp as an Adder and Subtractor	
11.	To verify the working of Opamp as Integrator and Differentiator	
12.	To verify the working of Opamp as Zero crossing detector.	

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Dr. S. K. Bhattacharya, Dr. Reu Vig	Principles Of Electronics	S.K Kataria & Sons
2	J. B. Gupta	Basic Electronics	S.K Kataria & Sons
3	V.K Mehta	Principles Of Electronics	S. Chand & Company

Reference Books For Further Study

S. No.	Author	Title Of Books	Publishers
1	J. B. Gupta	Electronic Devices & Circuits	Katsons
2	Ramakant Gayakwad	Linear Integrated Circuits	Prentice Hall Of India

Indian And International Codes Needed

S. No.	Author	Title Of Books	Publishers
1	Robert Boylestead	Electronic Devices & Circuits	Prentice Hall Of India
2	B.P. Singh Rekha Singh	Electronic Devices & Integrated Circuits	Pearson Education

(EL404) ELECTRONIC INSTRUMENTATION SYSTEMS

1. COURSE OBJECTIVES

This course enables students to understand the facts, concepts, principles and applications of instrumentation system. The student will be able to conduct installation, testing and commissioning especially related with transducers and control system, in the field of electrical and electronics.

2. TEACHING AND EXAMINATION SCHEME

Semester IV									
Course code & course title	**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**				
					Theory Marks		**Practical Marks**		**Total Marks**
(EL404) Electronic Instrumentation Systems	L	T	P	H	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	-	125

3. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:
EL404.CO1: Explain functions of components of instrumentation system.
EL404.CO2: Illustrate use of transducer for measurement of given quantities.
EL404.CO3: Discuss the working and applications of various components of instrumentation system.
EL404.CO4: Select suitable instrumentation system for a given measurement application

4. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
EL404.CO1	2	-	-	-	-	3	3
EL404.CO2	3	3	2	3	3	3	3
EL404.CO3	2	1	2	3	3	3	3
EL404.CO4	2	3	3	3	3	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
EL404.CO1	3	2
EL404.CO2	3	2
EL404.CO3	2	3
EL404.CO4	2	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
1. INTRODUCTION TO INSTRUMENTATION	**9**	**6**	**CO1, CO2, CO3**
Objective of instrumentation system, Block diagram of a general instrumentation system. Characteristics of ideal transducer, Classification of transducers: Active and passive transducers, Analog and digital transducers.			
2. TRANSDUCERS	**18**	**14**	**CO1, CO2**
2.1 Construction, operation and characteristics of passive transducers: Resistive transducers: Potentiometer, strain guage, (bonded and semiconductor) RTD, Thermistor Inductive transducers: by varying self inductance, mutual inductance, eddy current. LVDT Capacitive transducers: varying of distance, area, permittivity			
2.2 Active transducers (principle ,working and material used) Piezoelectric transducer Thermocouple Photoelectric transducers: LDR, Photodiode, Photo transistor, Photovoltaic cell Digital transducer: Shaft encoder			
3. TRANSDUCER APPLICATIONS	**21**	**14**	**CO1,CO2, CO4**
3.1 Displacement measurement: linear and angular displacement using resistive, capacitive, and inductive transducers. Angular speed measurement: photoelectric pickup, magnetic pickup Vibration measurement: piezoelectric accelerometer			
3.2 Pressure measurement: diaphragm with strain gauge Level measurement: Float operated, resistive method, capacitive method Flow measurement: electromagnetic flow meter and turbine meter			
4. SIGNAL CONDITIONING AND DATA PRESENTATION	**18**	**8**	**CO1, CO3**
4.1 Signal Conditioning: Need for signal conditioning Significance of DC & AC amplifiers, Instrumentation amplifier. Filters: Concept, significance, circuit (using passive components only) and characteristics of low pass, high pass and band pass filters Basic bridge circuits for strain gauge and RTD			
4.2 Data presentation elements: Digital display: Advantages and comparison of LED and LCD. Plotters: Strip chart recorder, XY plotter.			
5. APPLICATION OF INSTRUMENTATION SYSTEM	**9**	**6**	**CO1, CO3**
5.1 Block diagram, working and applications of Data acquisition system SCADA Process control			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	INTRODUCTION TO INSTRUMENTATION	6	9
2	TRANSDUCERS	14	18
3	TRANSDUCER APPLICATIONS	14	21
4	SIGNAL CONDITIONING AND DATA PRESENTATION	8	18
5	APPLICATION OF INSTRUMENTATION SYSTEM	6	9
	Total	48	75

8. SPECIFICATION TABLE FOR TERM WORK

No	**Practical** (Minimum 8)	Marks
1.	Displacement measurement using resistive transducer	
2.	Displacement measurement using inductive transducer	
3.	Displacement measurement using Capacitive Transducer	
4.	Displacement measurement using LVDT	
5.	Stress measurement using strain gauge.	
6.	Temperature measurement using resistance temperature detector	
7.	Temperature measurement using thermocouple	
8.	Speed measurement of motor using photo electric pickup/ magnetic pick up.	
9.	Level measurement transducer.	
10.	Obtain characteristics of Photodiode and phototransistor.	
11.	Obtain characteristics of LDR.	
12.	Study of piezoelectric transducer.	
	Total	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Sawhney A. K.	Electrical & Electronic measurement and instruments	Khanna Publisher
2	Rangan, C.S. et al	Instrumentation Devices and system	Tata Mc Graw Hill
3	Curtis Jhonson	Process control instrumentation Technology	Pearson/Prentice hall
4	Kalsi H. S.	Electronic instruments and measurement	Mc Graw Hill

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Murty, D.V.S.	Transducers and Instrumentation	Prentice Hall India

(EL406) ELEMENTS OF COMMUNICATION SYSTEM

1. COURSE OBJECTIVES

This course will enable the students to understand the basic concepts of communication system, modulation and demodulation techniques and transmitter and receiver circuits.

2. TEACHING AND EXAMINATION SCHEME

Semester	**IV**								
Course code & course title		**Periods/Week (in hours)**			**Total Hours**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
		L	T	P	H	TH	TM	TW	PR/OR	
(EL406) ELEMENTS OF COMMUNICATION SYSTEM		3	-	2	5	75	25	25	-	125

3. COURSE OUTCOMES:

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

EL406.CO1: Explain basic concepts of communication system
EL406.CO2: Demonstrate working of Modulator, Demodulator, Transmitter, Receiver and Colour TV
EL406.CO3: Compare various types of noise and communication techniques and equipments
EL406.CO4: Discuss the use of communication techniques and equipments for given application

4. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation& Testing	Engg. Practices for Society ,Sustainability& Environment	Project Management	Life -long Learning
EL406.CO1	2	-	-	-	-	-	-
EL406.CO2	3	1	-	3	-	2	-
EL406.CO3	2	1	1	-	-	-	2
EL406.CO4	2	2	2	-	3	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
EL406.CO1	2	2
EL406.CO2	3	3
EL406.CO3	2	2
EL406.CO4	2	2

5. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
1 BASICS OF COMMUNICATION SYSTEM	**9**	**5**	**CO1, CO3**
1.1 Block diagram of communication system Frequency bands used in communication system			
1.2 Noise: Definition, Classification of noise (Internal & External), Brief Explanation of each type of External noise (Atmospheric, Industrial, Extraterrestrial), Brief Explanation of each type of Internal noise(Thermal Agitation & Partition), Definition of signal to noise ratio & noise figure			
2 MODULATION AND DEMODULATION	**21**	**13**	**CO2, CO3**
2.1 MODULATION: Basic definition of modulation, Need for modulation, Types of Modulation (AM, FM, PM)			
2.2 Amplitude Modulation: Basic principle & Waveforms, Frequency Spectrum for AM wave (only description with sketches), Bandwidth for AM wave, Definition of modulation index for AM wave			
2.3 Angle Modulation : Definition & types of Angle Modulation Frequency Modulation : Basic principle & Waveforms, Frequency Spectrum for FM wave (only description with sketches), bandwidth for FM wave, Definition of modulation index for FM wave, Pre-emphasis and De-emphasis			
2.4 Phase Modulation : definition and mathematical expression Comparison between AM,FM & PM			
2.5 DEMODULATION: Basic definition of demodulation, Detection of AM Waves using Envelope detector and simple diode detector, Detection of FM wave using Balanced slope detector			
3 TRANSMITTERS AND RECEIVERS	**12**	**08**	**CO1, CO2**
3.1TRANSMITTERS: Block diagram of AM Transmitter-Low level and high level, Block diagram of FM stereophonic broadcast transmitter			
3.2 RECEIVERS: AM Receivers : Block diagram & Operation of TRF receiver, Block diagram & operation of Super heterodyne Receiver, AGC- need of AGC & Types of AGC (Simple, ideal & delayed) FM Receiver: Block diagram & operation FM Stereophonic receiver			
4 TV SYSTEMS AND ANTENNAS	**24**	**16**	**CO1, CO2, CO3**
4.1 Concept of scanning and synchronization and its need in TV system, Controls of TV receiver, TV standards for 625 line TV system, Basic principle of TV camera			

4.2 Block diagram for generation of colour difference signals, Block diagram of PAL colour television transmitter, Basic concepts and working of LCD and LED TV			
4.3 Antennas: Antenna parameters:-definitions of antenna gain, antenna resistance, beam width and polarization . Construction and radiation pattern of dipole, Yagiuda, parabolic reflector (horn feed) Antennas.			
5 INTRODUCTION TO MOBILE CELLULAR COMMUNICATION	**9**	**06**	**CO1, CO4**
5.1 Basic Cellular system- Block diagram and operation, Concept of frequency reuse channels			
5.2 Handoff mechanism and cell splitting, Concept of GSM and its architecture			
Total	**75**	**48**	

6. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

7. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	BASICS OF COMMUNICATION SYSTEM	5	9
2	MODULATION AND DEMODULATION	13	21
3	TRANSMITTERS AND RECEIVERS	08	12
4	TV SYSTEMS AND ANTENNAS	16	24
5	INTRODUCTION TO MOBILE CELLULAR COMMUNICATION	06	09
	Total	**48**	**75**

8 SPECIFICATION TABLE FOR TERM WORK

No	**Practical**	**Marks**
1.	Perform Amplitude Modulation on trainer kit. (Observe and draw the waveform of AM)	
2.	Perform Amplitude Demodulation on trainer kit.(Observe and draw the input waveform and output waveform)	
3.	Perform frequency modulation on trainer kit. (Observe and draw the waveform of FM).	
4.	Perform frequency demodulation on trainer kit.(Observe and draw the input waveform and output waveform)	
5.	Test the performance of Superheterodyne Receiver on trainer kit.(Observe the wave forms at various points in AM receiver)	

6.	Identification of faults in different sections of TV transmitter.	
7.	Identification of various sections of mobile handset.	
8.	Field visit to All India Radio Transmitter Station	
	Total	25

9. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Kennedy, George and Bernard	Electronic & Communication System	Tata McGraw Hill, India, ISBN:0-07-463682-0
2	Roddy Collen	Electronic communication	Prentice Hall of India Private India ISBN:81-203-0984-7
3	R. R. Gulati	Colour Television	New Age International(P) Limited Publishers, New Delhi ISBN:81-224-0008-6
4	William C. Y. Lee	Mobile Cellular Telecommunications	Tata McGraw Hill, India ISBN-13:978-0-07-063599-9 ISBN-10:0-07-063599-4