BISHNUPUR PUBLIC INSTITUTE OF ENGINEERING

SUB NAME: Switchgear and Protection SUBJECT CODE:EE/S5/SWGRP

SL NO	UNIT	Day	TOPIC	OUTCOME			
				objective	**Input**	**Learning Outcome**	**Google attendance**
1	**Fundamental**	1	Necessity & functions of protective system.	Basic of Short Ckt & overload	Fault Circuit	Need of protection in electrical network	
		2	Normal & abnormal conditions & types of faults & their	Know different types offaults	Symmetrical & unsymmetrical fault	How to choose a Protective scheme for different faults	
		3	Use of current limiting reactors & their arrangements.	Application of Reactor	How Reactor works	Using time of Reactor	
		4	Short-circuit KVA calculations for symmetrical faults – problems.	Numerial Calculation need to use protective device	Per unit System	Full knowledge on per unit calculation	
2	**ircuit interrupting devic**	5	Fuse element, rated current, fusing current,	Construction 0f Fuse	Fuse	Know all details about fuse construction	
		6	fusing factor, prospective current, cut-off current	Choose Fuse for right sy	Rating of fuse	know which fuse economical for which system	
		7	Arcing time, rupturing capacity, total operating time. Fuse Characteristics.	Operation of Fuse	Charecteristics	Operating principle	
		8	HRC fuses – construction, types, working, characteristics, selection and applications	Industrial uses of Fuse	Rupturing capacity	Selection of fuse for industrial purpose	
		9	Isolators- vertical break, horizontal break & pentograph type	Use of isolator with bus	Isolator mechanism	Selection of Isolatorwith protective device	
		10	Arc formation process, methods of arc extinction, related terms.	Know about arc	Arc formation & extingusi	How Arc formed & how we will extinguished it	
		11	Circuit breakers- Concept, Classification, Working principle, Construction, Specification & Applications of CB	Concept & operation of	Construction & operation of C.B	Full Knowledge to choose a C.B	
		12	E.H.V/H.V – Minimum oil circuit breakers (M.O.C.B.), Air Blast Circuit Breaker (A.B.C.B)	Different system different need	Classification	Which C.B need for which system	
		13	Sulpher Hexa Fluoride circuit breaker (SF6). vacuum circuit breaker.	Different system different need	Classification	Which C.B need for which system	
		14	L.V.- Air circuit breakers (ACB),miniature circuit breakers (M C B) , Moulded case circuit breakers (M C C B)	Different system different need	Classification	Which C.B need for which system	
		15	Earth leakage circuit breaker (E L C B or R C CB), Comparison of fuse & MCCB	Different system different need	Classification	Which C.B need for which system	
		16	Selection of MCCB for motor.	Why MCCB mendatory for motor protection	Motor protection	How we protect motor	
		17	Selection and rating of circuit breaker	How we select Best C.B	Rating of C.B	Best C.B chosen for our System	
		18	Breaking capacity, making capacity, rated operating duty, rated voltage.	Capacity need for chosen a C.B	Withstand Capacity	Chose C.B depends on Rated voltage	
		19	Elementary idea of Auto-reclosing.	Automatical Closing nee	Auto_reclose	How C.B automatically closed to makea Ckt.	
3	Protective Relaying	20	Protective Relaying:Zones of protection, primary & back-up protection	Choose Relaying protec	Different types of protect	Know for selection a Relay	
		21	Essential qualities of protection, classification of protective schemes, basic relay terminology.	Relaying Technology	Relay Circuit	How to operate a relay	
		22	CT & PT used in protection: Requirements, Basic circuit diagram, working principle & application of CVT and CCVT.	Why CT & PT need to selection of relay	CT & PT Requirement	Apllication & uses of CT & PT	
		23	Operating principles and construction (in brief) of: Electromagnetic relays, Thermal relays	Priciple of Electromagnetic Relay	Need & Operation of Electromagnetic Relay	Electromagnetic relay Chosen purpose	
		24	Static relays (with merits and demerits), and Microprocessor based relays, Auxiliary switch Flags – conception only.	Concept to choose different relay	Auxillary swith With different relay	Auxilary switch need, Different relay chosen for different	
		25	Over current relay--- Time-current characteristics of definite time, instantaneous, inverse time and IDMT Relays.	Concept to use Overcurrent relay for industrial operation	classification & operation of Over current Relay	Different over current relay chosen for different system	
		26	Use of very inverse-type O/C relay and extremely inverse type O/C relay.	Concept to use inverse O/C relay for industrial operation	Operation of inverse O/C	Why Inverse O/C relay need	
		27	Time-setting, current-setting, PSM – problems.	TSM & PSM calculation for selection	TSM & PSM	Select a Reliable Relay for Operation	
		28	Directional Relay - Introduction, Characteristics : Constant product characteristics, Polar characteristics, Concept of dead zone.	Directional Relay operation & charecteristics	Directional Relay Needed	Need of Directional Relay in Railways or shopping mall etc	
		29	Distance Protection Scheme : Area of applications, Impedance relays,	Distance protection realy operational area	Distance protection needs	Distance protection uses	

		30	Reactance relay, MHO relay : operating characteristics, effect of arc resistance on their characteristics	Mho Relay operation & charecteristics	Mho Relay Needs	Uses of Mho relay for Compensated & uncompensated	
		31	Differential Relay : Introduction, Current differential protection for an internal fault – fed from single & both end.	Differential Relay's operation on Transformer or	Differential Relay's needs	Feding Knowledge with ckt diagaram & directional relay's	
		32	Static over current relays	Static over current relays operation	Static over current relays needs	Static relay use as Electrical opted switch	
		33	µP based over current relays.	µP based over current relays operation	µP based over current relays needs	µP relay use & why need for testing purpose mainly	
4	Equipment Protection	34	Generator protection – Percentage differential stator protection,	Percentage differential protection scheme description	Percentage differential protection scheme needs	protection of Generator using Percentage	
		35	Brief idea of: - rotor protection due to loss of excitation	How to protect rotor of any electrical machine	rotor protection needs	Rotor protection with loss of excitation	
		36	protection against rotor overheating because of unbalance in load	How to protect rotor againt over load	Overload protection	Overload protection on Industrial machinaries	
		37	overspeed protection, protection against motoring and field suppression.	Different types machine protection Formula & ckt	Needs to machine protection	Different protection on Industrial machinaries for	
		38	Transformer protection - Percentage differential protection – problems	Numerial Calculation need to use for transformer	Percentage differential protection	Numerial problems for better understanding	
		39	Buchholz Relay, rate of rise of pressure relay, over-fluxing protection, O/C protection.	Buchholz Relay & its Operation	Needs for using Buchholz Relay	Buchholz relay operation O/C protection	
		40	Protection of Motor: Abnormalities & faults. Short circuit protection	Motor protection due to abnormalities	Motor protection needs	Uses & fundamental of motor protection	
		41	Overload protection, Single phase preventer.	Electrical Machinaries Overload protection	Overload protection	How to proctect Your motors due to overloadrunning	
		42	Protection of Busbar & transmission line	Protection of Busbar & transmission line using protective device	Transmission line protecti	How to protect Transmission line	
5	Over voltage Protection	43	Over voltage Protection: Causes of over voltages.	Why overvoltage on electrical system occurs & how protect	Overvoltage due to lightni	Overvoltage protection Phenomena	
		44	Lighting phenomena & over voltage due to lightning.	How Lightning occurs & how it effect on transmission line	Lighting phenomena	Lightning phenomena for better protection	
		45	Protection of transmission line & substation from direct stroke.	How Direct strokes effect on electrical lines	Different types of srtoke	Prevention from direct stroke	
		46	Types of lightning arresters & surge absorbers & their Construction & principle of operation.	Classification & needs of Lightning protection Device	lightning arresters & surge absorbers	Uses & operation of Lightning arresters & surge absorbers	
		47	Protection against traveling waves.	Protection against Traveling waves on lightning	Traveling waves	Traveling wave nature & protection	
		48	Insulation co-ordination.	Needs of insulation due to protect from different surges	Needs of insulation	Fundamental for plotting any ckt. insulation	

prepared by
ARKA GHOSAL
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BISHNUPUR PUBLIC INSTITUTE OF ENGINEERING

SUB NAME: Energy Conservation and Audit (Elective) **SUB CODE: EE/S5/ECA(EL)**

SL NO		Day		OUTCOME			GOOGLE ATTENDANCE
				OBJECTIVE	**INPUT**	**LEARNING OUTCOME**	
1	Energy	1	Review of various energy sources	Classification of energy sources	Different Kind of energy	Details about Energy resourses	
2		2	Need of energy conservation	How to reduce consumption of Energy	Consumption Energy	Reduced need ofenergy & increased enviromental quality	
3		3	energy audit.	Survey & analysis of Energy flow	Flows of energy	Report on Energy conservation	
4	Energy Conservation	4	Lighting energy: methods/Techniques of efficient lighting	Generate hydrogen from water	Lightning mathods	Rapid heating of water due to lightning	
5		5	Heating: methods/Techniques of energy Saving in Furnaces	Heat transferred	Conduction,convection,radiation	Breif knowledge on heat transfer	
6		6	Heating: methods/Techniques of energy Saving in Ovens and Boilers	Heated air circulated	Convection ovens	Food cooking	
7		7	Cooling: methods/Techniques of Energy Saving in Ventilating systems	Heat cooling indor & outdoor	Thermostat	Cooling with low amount of energy used	
8		8	Cooling: methods/Techniques of Energy Saving in Air Conditioners	Needs of AC cooler	Cooling appliance	operation mechanism of cooler	
9		9	Motive power, Energy Efficient Motors	Same output strength by low amount of power	Electrical motor needs	Calculation of motor efficiency for different uses	
10		10	Efficient use of energy in motors with the help of voltage reducers,	To reduce electrical consumption by adjusting speed	Voltage reducer or varriac	How to save consumption	
11		11	automatic star/ delta converters	Reducing current	Star Delta connection	using Delta connection during load	
12		12	and softstarters/Variable Frequency Drives.	Output control directly changing torque	VFD	Uses & application of VFD	
13		13	Power factor improvement devices	Improving power quality with reducing load	Capacitor bank	Uses of Capacitor bank	
14		14	Amorphous Core Transformers Cogeneration -Types and Advantages	CRGO transformer reduction no load losses using CRGO core	CRGO Transformer	Uses & needs of CRGO transformers in industry	
15	Tariff and Energy Conservation in Industries	15	Energy cost	Price Chart	kWh	Need of fuel cost calculation	
16		16	Recent WBSEB tariffs	WBSEB tariffs Details	Per unit system	Need for industrial & household calculation	
17		17	Application of Tariff System to reduce Energy bill	Reducing Peak power Demand		how to reduce Electricity bill	
18		18	Energyconservation by improving load factor	Reduced demand by distributing Loads over different time periods	Keeping Stable demand	Save Energy consumption	
19		19	Energyconservation by improving and power factor	Improving power quality with reducing load	Capacitor bank	Uses of Capacitor bank	
20	Energy Conservation In Transmission and Distribution Systems:	20	Reactive power compensation,	Different technologies for reactive power compensation	Series compensator	Improve ac system	
21		21	demand side management	Modification of consumer demand	Financial incentives & behavioral change	Efficient management of side energy consumption	
22		22	phase current balancing	Reduce Unbalance Load	Merz price system	Minimize Different losses	
23		23	system voltage optimization and	Resuction of Receiving Voltage	Voltage optimizer	Improve power quality	
24		24	Losses in transmission and	Copper & induction loss	Line losses	High sending output voltage for reduced loss	
25		25	distribution system and its minimization	Uses of Underground cable	Different types of factor	Uses & disadvantage of Underground cable over overhead cable	
26	Energy and the Environment:	26	Environment and social concerns related to energy utilization	how to save environment	conservation,utilization	healty environment	
27		27	The green house effect, Global Warming and its effect	how global warming occur	CO, CO2, methen	green house gasses	
28		28	Pollution, Acid Rains	how pollution occur	CO, H2SO4	green house gasses	
29		29	Global Energy and environment Management	how to protect environment	reduce green house gas	healty environment	
30	Energy Audit	30	Procedure of Energy audit, ABC analysis,	what is energy audit	ABC analysis	energy audit	
31		31	Energy Flow Diagram and its importance	what isenergy flow diagram	utilization of energy	energy conservation	
32		32	Measurements in energy audit and various measuring instruments	how energy measure	energy meter	ammount of energy	
33		33	Questionnaires for the energy audit,	about energy audit	error and accuracy	accurate energy audit	
34		34	internal energy audit checklist	what is energy audit checklist	types of energy audit	different audits	
35		35	Equipment used for energy conservation,	energy saving equipment	LED, LCD,energy saving motor	conservation of energy	

36	36	Calculation of payback period for energy conservation equipment	what is payback period	different instrument	payback period of energy conservation	
37	37	IE rules and regulations for energy audit	what is energy ragulation	E.I rules	regulation of energy	
38	38	Electricity act 2003 (Numerical)	what is electricity act	different electricity act	conservation of energy	

Prepared by Arka Ghosal &
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Lecturer In Electrical Department

BISHNUPUR PUBLIC INSTITUTE OF ENGINEERING

DEPARTMENT OF ELECTRICAL ENGINEERING

SUBJECT: POWER ELECTRONICS (EE/SS/PED)

SEM: 5TH SEMESTER, PART-III

LECTURER: SIDDHARTHA CHAKRABORTY

SL NO	DAY	UNIT	TOPICS TO BE COVERED	OUTCOME			GOOGLE ATTENDANCE
				OBJECTIVE	INPUT	LEARNING OUTCOME	
1	1	1. POWER SEMICONDUCTOR DEVICES: THYRISTOR (SCR)	Construction, operation & symbol.	CONCEPT OF SWITCHES	OPERATION, SYMBOL, CHARACTERISTICS	USEFUL IN VARIOUS CIRCUITS	
2	2		V-I characteristics of SCR (Holding current, Latching current, Breakover voltage).	CONCEPT OF SCR	IL, IH, V I CHARACTERISTICS	STRONG CONCEPT ABOUT SCR	
3	3		Turn on methods - Voltage triggering, Gate triggering, dv/dt triggering.	CONCEPT OF SCR TRIGGERING	VARIOUS TRIGGERING METHODS	STRONG CONCEPT ABOUT SCR	
4	4		Turn off methods – Current reduction, AC line commutation, Forced commutation.	CONCEPT OF SCR COMMUTATION	VARIOUS COMMUTATION METHODS	STRONG CONCEPT ABOUT SCR	
5	5		Thyristor specifications – voltage rating, current rating, power rating, dv/dt, di/dt, Gate current, temperature	CONCEPT OF SCR RATINGS CONCEPT OF SCR RATINGS	VOLTAGE, CURRENT, POWER RATINGS USES dv/dt, di/dt/ pulse duration calculation	STRONG CONCEPT ABOUT SCR STRONG CONCEPT ABOUT SCR	
6	6		Utility of Snubber circuit , Freewheeling diode.	PROTECTION OF SCR	RC CKT, FD	FUNCTION OF INDUCTOR, SNUBBER CIRCUIT	
7	7		DIAC, TRIAC, SCS – Principle of operation, characteristics & application.	OPERATION OF SCR	DIAC , TRIAC, SCR OPERATION	OTHER SEMICONDUCTOR SWITCHES OPERATION	
8	8		IGBT - Principle of operation, characteristics & application	CONCEPT OF SWITCHES	IGBT V I CHARACTERISTICS, OPERATION	OTHER SEMICONDUCTOR SWITCHES OPERATION	
9	9						
10	10	2. Switching & Timer Circuits	Simple transistor timer using R-C as timing element.	CONCEPT OF TIMER CIRCUIT	TIMER CIRCUIT, RC TIMING ELEMENTS	USES IN TIMER CIRCUIT CONCEPTS	
11	11		Classification of multi-vibrators.	CONCEPT OF MULTIVIBRATORS	MULTI VIBRATORS, TYPES, OPERATIONS	USES IN TIMER CIRCUIT CONCEPTS	
12	12		Study of Astable, Monostable & Bistable multivibrator using op amps	CONCEPT OF MULTIVIBRATORS	ASTABLE, BISTABLE , MONOSTABLE	USEFULE IN DIGITAL, ANALOG ELECTRONICS	
13	13		Internal block diagram, Pin diagram and operating of IC 555.	TIMER CIRCUIT	IC555 TIMER PIN DIAGRAM , BLOCK DIAGRAM	KNOWLEDGE ON IC555 TIMER	
14	14		Study of Astable, Monostable & Bistable multivibrator circuits using IC 555 timer	TIMER CIRCUIT	DIAGRAM OF MULTIVIBRATORS USING IC555	VERY MUCH USEFUL IN MACHINE, INDUSTRIES	
15	15	3. Converter and Inverter AC to DC Converter	Single phase fully controlled Half Wave Converter - with resistive load,	RECTIFIER CONCEPT	HALF WAVE R LOAD, WAVEFORM , CKT SCR & DIODE, CALCULATION,	USEFUL TO UNDERSTAND RECTIFIER AND OPERATION	
16	16		Single phase fully controlled Half Wave Converter - with R L LOAD,	RECTIFIER CONCEPT	HALF WAVE R L LOAD WAVEFORM, CKT,SCR & DIODE, CALCULATION	USEFUL TO UNDERSTAND RECTIFIER AND OPERATION	
17	17		Single phase fully controlled Full Wave Converter - with resistive load,	RECTIFIER CONCEPT	FULL WAVE, R LOAD , CKS, SCR, DIODE, WAVEFORM, CALCULATION	MAIN CONCEPT OF RECTIFIER , WHICH IS USEFUL IN DC MACHINE DRIVES	
18	18		Single phase fully controlled Full Wave Converter - with R L load,	RECTIFIER CONCEPT	FULL WAVE, R L LOAD , CKS, SCR, DIODE, WAVEFORM, CALCULATION	MAIN CONCEPT OF RECTIFIER , WHICH IS USEFUL IN DC MACHINE DRIVES	
19	19		Three phase fully controlled Bridge Converter - with RL load	RECTIFIER CONCEPT	3 PHASE FULL WAVE, R L LOAD , CKS, SCR, DIODE, WAVEFORM, CALCULATION	MAIN CONCEPT OF RECTIFIER , WHICH IS USEFUL IN DC MACHINE DRIVES	

20	20	**4. Cycloconverter**	Principle of operation of Single phase & Three phase cycloconverter	CYCLOCONVERTER CONCEPT	CKT, CONCEPT OF FREQUENCY CHANGING	USEFUL IN VARIOUS MACHINE DRIVES IN INDUSTRY	
21	21		Basic circuit diagram, input & output waveforms	CYCLOCONVERTER CONCEPT	CKT, WAVEFORM, WORKING, OPERATION	USEFUL IN VARIOUS MACHINE DRIVES IN INDUSTRY	
22	22	**5. INVERTER**	Classification of Single phase & Three phase Inverter	INVERTER COPNCEPT	MAIN CONCEPT OF INVERTER, TYPES, SWITCHES, CONNECTION	USEFUL IN INVERTER CONCEPT	
23	23		Line commutated & Forced commutated Inverters	INVERTER COMMUTATION	LINE AND FORCED COMMUTATION OF INVERTER	USEFUL IN INVERTER COMMUTATION CONCEPT	
24	24		series & Parallel, Bridge Inverter	TYPES OF INVERTER	SERIES & PARALLEL CKT, WAVEFORM,CALCULATION	USEFUL IN INVERTER USES CONCEPT	
25	25		Operation of basic Series Inverter.	SERIES INVERTER	SERIES CKT, WAVEFORM, CALCULATION	USEFUL IN INVERTER CONCEPT	
26	26		Operation of basic Parallel Inverter.	PARALLEL INVERTER	PARALLEL CKT, WAVEFORM,CALCULATION	USEFUL IN INVERTER CONCEPT	
27	27		Operation of Single phase Bridge Inverter	BRIDGE INVERTER	BRIDGE TYPE CKT, WAVEFORM,CALCULATION	USEFUL IN INVERTER CONCEPT	
28	28		Pulse Width Modulated Inverter	INVERTER CONCEPT	PWM TECHNIQUE, PWM TYPES, SPWM,	SPECIAL INVERTER USEFUL IN CONTROLLING MACHINE DRIVES	
29	29	**4. DC Chopper**	Principles of chopper.	CHOPPER CONCEPT	USES OF CHOPPER, MAIN CONCEPT	USEFUL IN CHOPPER CONCEPT BUILDING	
30	30		a) Step-up & Step-down chopper	TYPES OF CHOPPER	STEP UP, STEP DOWN WITH CKT, WAVEFORM, CALCULATION ,WORKING	PRINCIPLE OF OPERATION OF MAIN TWO TYPES OFCHOPPER	
31	31		b)Second quadrant, Two quadrant & Four quadrant operation	TYPES OF CHOPPER	FOUR QUADRANT OPERATIONS OF CHOPPER	USEFUL IN CHOPPER CONCEPT	
32	32		Type-A, B, C, D chopper – Operating Principle.	TYPES OF CHOPPER	TYPE A, B, C, D CHOPPER , WORKING, WAVEFORM, CALCULATION	USEFUL IN CHOPPER CONCEPT, AND QUADRANT OPERATION	
33	33		Commutations methods for choppers – Auxiliary commutation, Load commutation.	COMMUTATION OF CHOPPER	COMMUTATION METHODS OF CHOPPER	USEFUL IN CHOPPER CONCEPT	
34	34		Jones chopper.	SPECIAL CHOPPER	WORKING OF JONES CHOPPER, WAVEFORM, CKT	SPECIAL CHOPPER CONCEPTS AND USES	
35	35		Speed control of separately excited DC motor by single phase fully controlled converter.	DC MOTOR SPEED CONTROL	DC MOTOR WORKING, DIAGRAM, CONTROLLING PARAMETERS	USEFUL IN CONTROLLING THE SPEED OF A DC MOTOR DRIVES	
36	36			DC MOTOR SPEED CONTROL	1 PH RECTIFIER WORKING, WITH USING IN DC M/C DRIVES	USEFUL IN CONTROLLING THE SPEED OF A DC MOTOR DRIVES	
37	37			DC MOTOR SPEED CONTROL	3 PHASE FULLY CONTROLLED CONVERTER	USEFUL IN CONTROLLING THE SPEED OF A DC MOTOR DRIVES	
38	38		Speed control of separately excited DC motor with three phase fully controlled converter	DC MOTOR SPEED CONTROL	WORKING WITH DC M/C DRIVES	USEFUL IN CONTROLLING THE SPEED OF A DC MOTOR DRIVES	

39	39		Speed control of DC series motor with chopper control	DC SERIES MOTOR SPEED CONTROL	HOW TO USE CHOPPER TO CONTROL THE SPEED OF A DC MOTOR	USEFUL IN CONTROLLING THE SPEED OF A DC MOTOR DRIVES	
40	40		Speed control of DC servomotor.	DC SERVO MOTOR SPEED CONTROL	SERVO MECHANISM, CONTROLLING PARAMETERS	USEFUL IN CONTROLLING THE SPEED OF A DC SERVO MOTOR DRIVES	
41	41		Speed control of Three phase Induction motor with variable frequency PWM VSI.	SPEED CONTROL OF IM VVVF	IM SPEED CONTROLLING PARAMETERS	USEFUL IN CONTROLLING THE SPEED OF A INDUCTION MOTOR DRIVES	
42	42	**5. DC & AC Drives**		SPEED CONTROL OF IM VVVF	VVVF METHOD, PWM WITH VSI	USEFUL IN CONTROLLING THE SPEED OF A INDUCTION MOTOR DRIVES	
43	43			SPEED CONTROL OF IM VVVF 3 PH	FREQUENCY CONTROL, GRAPH, WORKING,	USEFUL IN CONTROLLING THE SPEED OF A INDUCTION MOTOR DRIVES	
44	44		Speed control of Three phase Induction motor with variable voltage variable frequency control.	SPEED CONTROL OF IM VVVF	EQUIVALENT CIRCUIT DIAGRAM	USEFUL IN CONTROLLING THE SPEED OF A INDUCTION MOTOR DRIVES	
45	45		Speed control of AC servomotor. Speed control of AC servomotor.	AC SERVOMOTOR SPEED CONTROL	EQUVALENT CKT, CONTROLLING PARAMETERS , WORKING	USEFUL IN CONTROLLING THE SPEED OF A AC SERVO MOTOR DRIVES	
46	46			CONCEPT OF VAR COMPENSATION	OPERATING PRINCIPLE, CALCULATION	CONCEPT OF VAR COMPENSATION AC MOTOR DRIVES	
47	47		Static VAR compensation system - Principle of operation & Block diagram.	CONCEPT OF VAR COMPENSATION	BLOCK DIAGRAM, VAR COMPENSATION	CONCEPT OF VAR COMPENSATION AC MOTOR DRIVES	
48	48			CONCEPT OF UPS	OPERATION OF ON LOAD TYPE UPS,WITH BLOCK DIAGRAM	CONCEPTOF UNINTERRUPTED POWER SUPPLY	
49	49		Uninterrupted power supply – Principle of operation & Block diagram of On load & Off load type UPS.	CONCEPT OF UPS	OPERATION OF OFF LOAD TYPE UPS,WITH BLOCK DIAGRAM	CONCEPTOF UNINTERRUPTED POWER SUPPLY	

BISHNUPUR PUBLIC INSTITUTE OF ENGINEERING							
SUB NAME: Utilization, Traction, Heating and Drives				SUBJECT CODE: EE/S5/UTHD			
SL NO	UNIT	Day	TOPIC TO BE COVERED	OUTCOME			
				OBJECTIVE	INPUT	LEARNING OUTCOME	GOOGLE ATTENDANCE
1	Illumination:	1	Light, Luminous Flux, Luminous Intensity, Lumen, Candle Power, Illumination, Lux or Meter Candle,	INTRODUCTION ON ILLUMINATION	CANDLE POWER, LUX	CONCEPT OF ILLUMINATION,	
2		2	Mean Horizontal Candle Power (MHCP), Mean Spherical Candle Power (MSCP), Mean Hemi-spherical Candle Power (MHSCP)	LIGHT DIRECTION	MHCP, MSCP, MHSCP	LIGHTING ILLUMINATION FACTOR	
3		3	Reduction Factor, Lamp Efficiency, Specific Consumption, Glare, Space-Height Ratio, ,	ILLUMINATION FACTOR	LAMP OUTPUT, GLARE	ILLUMINATION CALCULATION	
4		4	Utilization Factor, Maintenance Factor, Depreciation Factor, Colour Renderng Index	ILLUMINATION FACTOR	UF, MF ,DF VALUE	ILLUMINATION CALCULATION	
5		5	Waste Light Factor, Absorption Factor, Reflection Factor, Solid Angle, Beam Angle	ILLUMINATION FACTOR	SOLID ANGLE, & AF, WF,RF	ILLUMINATION CALCULATION	
6		6	Laws of Illumination: Law of Inverse Squares- Lambert's Cosine Law. (No Numerical) Types, basic principle, Details Specifications and application	ILLUMINATION MEASURE	INVERSE SQUARE & LAMBER COSINE	ILLUMINARION CALCULATION FORMULA	
7		7	Incandescent Lamps. Halogen Lamps. Low Pressure Mercury Vapour Lamps (Fluorescent Tube).	FAMILIER WITH LAMP	MV, HALOGEN, TUBE LIGHT	USES OF LAMPS	
8		8	High Pressure Mercury Vapour Lamps. Sodium Vapour Lamps	FAMILIER WITH LAMP	MERCURRY, SODIUM VAPOUR	USES OF LAMPS	
9		9	Compact Fluorescent Lamps (C.F.L.) Metal Halide Lamps	FAMILIER WITH LAMP	CFL	USES OF LAMPS	
10		10	LED Lamps Neon Signs	FAMILIER WITH LAMP	LED, NEON	USES OF LAMPS	
12		11	Advantages of Electric Heating. Classification of Electric Heating Methods:	INTRODUCTION ELECTRIC HEATING	DIRECT & INDIRECT HEATING	METHODS OF HEATING	
13		12	Resistance Heating:(Construction, Operation and application) Direct Resistance Heating: Salt Bath Furnace	RESISTANCE HEATING CONCEPT	SALT BATH FURNACE	INDUSTRY & COMMERCIAL DOMESTIC APPLICATION	
14		13	Indirect Resistance Heating: Resistance Ovens, Requirements of Heating Element Material, Name of some common heating element materials,	RESISTANCE MATERIALS	Resistance Ovens, NICHROME	INDUSTRY & COMMERCIAL DOMESTIC APPLICATION	
17		14	Causes of Failure of Heating Elements, Methods of Temperature Control.	HEATING CONTROL		KNOWN TO HEATING TROUBLE SHOOTING	
19		15	Arc Heating: (Construction, Operation and application) Direct Arc Furnace, Indirect Arc Furnace.	Arc Heating	ARC FURNACE	USES OF ARC HEATING	

21		16	Induction Heating: (Construction & Operation and application) Core Type Induction Furnaces: Ajax Wyatt Furnace.	CONCEPT ON INDUCTION HEATING	MUTUAL INDUCTION	USES OF INDUCTION HEATING	
23	**Electric Heating and Welding:**	17	Coreless Induction Furnace	CONCEPT ON INDUCTION FURNACE	CORELESS FURNACE	STEEL INDUSTRY APPLICATION	
24		18	Dielectric Heating:Principle of Dielectric Heating. Advantages of Dielectric Heating	CONCEPT ON DILELECTRIC HEATING	DIELECTRIC	INSULATING MATERIALS HEATING	
25		19	Limitations of Dielectric Heating. Applications of Dielectric Heating	LIMITATION ON DIELECTRIC HEATING	DIELECTRIC	LIMITED CUSES OF ITS	
26		20	Power supply requirement and simple numerical of above heating methods. (No deduction of any formula	HEATING MEASUREMENT	FORMULA	HEATING CALCULATION	
27		21	Methods of Electric Welding Resistance Welding: Principle of Resistance Welding	CONCEPT ON WELDING	ELECTRODE, MATERIALS	USES OF ITS	
28		22	Advantages of Resistance Welding. Types of Resistance Welding - (Only List) Spot Welding Machine.	CONCEPT RESISTACE WELDING	SPOT WELDING MACHINE	USES & WORKING	
29		23	Electric Arc Welding: - Formation and Characteristics of Electric Arc. - Effect of Arc Length. - Arc Blow.	CONCEPT ON ARC WELDING	ARC BLOW	USES & WORKING	
30		24	V-I Characteristics required for of Arc Welding. Arc Welding Machines: DC Welding Machines - MG Set, AC Rectified Welding Unit	ARC WELDING CHARACTERISTICS	MG Set, AC Rectified	KNOWN TO HANDLING OF WELDING MACHINE	
31		25	AC Welding Machines - Welding Transformer	AC Welding Machine	Welding Transformer	KNOWN TO AC WELDING MACHINE	
32	**Electric Drives:**	26	Introduction. Drives - Mechanical Drive and Electric Drive. Advantages and Disadvantages of Electric Drive	CONCEPT OF DRIVES,	DRIVES	KNOWN TO DRIVES FAMILY	
34		27	Factors Governing Selection of Electric Motors. Comparative discussion between the various Electric drive duties - continuous, short-time & intermittent.	DRIVES EFFECTING FACTOR	continuous, short-time & intermittent	KNOWLEDGE ON DRIVES LOAD	
35		28	Requirements of various types of common loads such as - Hoist, Elevator	USES OF MOTORS	DC MOTOR, INDUCTION MOTOR	USES & OPERATION ON ITS	
36		29	Conveyor, Rolling mills, Centrifugal pumps	USES OF MOTORS	DC MOTOR, INDUCTION MOTOR	USES & OPERATION ON ITS	
37		30	Punches, Shears etc.	USES OF MOTORS	DC MOTOR, INDUCTION MOTOR	USES & OPERATION ON ITS	
38		31	Selection of motors in respect of types, size and rating for above loads on the basis of mechanical characteristics	MOTOR SIZE & RATING	KW, HP,KV, KA…	SELECTION OF MOTOR	

40		32	speed control, reversibility, working environment and cost.	MOTOR CONTROL	BRAKING	MOTOR OPERATION	
41	**Electric Traction:**	33	Introduction: History of electric traction Various systems of traction. Electric traction Vs other traction systems	HISTORY & CONCEPT OF TRACTION	ELECTRIC TRACTION	KNOWN TO SOURCE OF TRACTION	
42		34	Electric Traction as viable transport strategy for 21st Century -Choice of traction system: Diesel-electric or Electric. 4.2 Electric Traction:	COMPARISON OF TRACTION SYSTEM	DISEL, COAL LOCOMOTIVE	EFFICIENT MEASURE OF DIFFERENT TRACTIOBN	
43		35	Different systems of track electrification (Block diagram) DC, AC, Composite. Advantage & disadvantages of each.	TRACK ELECTRIFICATION	DC, AC, Composite.	POWER SOURCE OF TRACTION	
44		36	analysis of single phase 25 KV AC system and DC system	POWER DIAGRAM	25 KV AC system and DC system	TOTAL POWER LAYOUT	
45		37	Traction Mechanics: Units Used in Traction Mechanics. Types of Services	TRACTION SERVICE	URBAN , SUURBAN	PRACTICAL RUNNIG SYSTEM OF TRACTION	
46		38	Speed Time Curve. Simplified Speed Time Curve (No Derivation) Average Speed and Schedule Speed.	TRACTION SERVICE VIEW BY GRAPH	Speed Time Curv	TRACTION SYSTEM MEASUREMENT	
47		39	Factors Affecting The Schedule Speed. Tractive Effort	TRACTION AFFECTING FACTOR	Tractive Effort, Schedule Speed.	TRACTION SYSTEM MEASUREMENT	
48		40	Specific Energy Consumption Factors Affecting Specific Energy Consumption	TRACTION AFFECTING FACTOR	Specific Energy Consumptio	TRACTION SYSTEM MEASUREMENT	
49		41	(Simple Numerical on Simplified Speed Time Curves and Specific Energy Consumption) Mechanics of train movement,Adhesion & coefficient of	TRACTION SYSTEM CALCULATION	Adhesion & coefficient	EFFICIENCY MEASUREMENT	
50		42	concept of weight transfer, effect of unsprung mass and wheel diameter.Traction Motors:	CONCEPT ON TRACTION LOAD	.Traction Motors	TRACTION LOAD	
51		43	Desirable Characteristics of Traction Motors, Special features of traction motor. Suitability of DC Series Motor for Traction,Suitability of Three Phase Induction Motor for Traction	CHARACTERISTICS OF TRACTION MOTORS	DC Series Motor,Three Phase Induction	SUITABILITY OF TRACTION MOTOR	
52	**Economic Aspects of Utilising Electrical Energy:**	44	Economic Aspects of Utilising Electrical Energy. Costing of Electrical Energy: Fixed Charges, Semi Fixed Charges, running Charges.	CONCEPT ON ECONOMICS OF ELECTRICAL	Fixed Charges, Semi Fixed Charges,	UTILISING OF ELECTRICAL ENERGY	
53		45	Formulation of Electrical Tariffs. Various Types of Tariffs: Tariffs in force for Domestic, Commercial and Industrial Consum	FORMULATION OF TARIFF	TARIFF	BILLING SYSTEM KNOWN	
54		46	Energy Conservation: Importance and need of Energy Conservation	ENERGY CONSERVATION	LOW ENERGY CONSUMPTION DEVICE	SAVING ENERGY & IMPROVE EFFICCIENCY	
55		47	Measures for Energy Conservation in(i)Electric Drives(ii) Electric Traction	ENERGY CONSERVATION IN TRACTION	Electric Drives (ii)Electric Traction	SAVING ENERGY & IMPROVE EFFICCIENCY	

56		48	Electric Heating (iv) Refrigeration and Air Conditioning (v) Illumination	ENERGY CONSERVATION ON THIS EQUIPMENT	Refrigeration and Air Conditioning (v)	SAVING ENERGY & IMPROVE EFFICCIENCY		

Prepared by

Prabhat Khanra & Amit Mukherjee

Lecturer in Electrical Dept

BISHNUPUR PUBLIC INSTITUTE OF ENGINEERING								
DEPT. OF ELECTRICAL ENGINEERING								
SUBJECT: MICROPROCESSOR AND MICROCONTROLLER								
SEM: 5TH SEMESTER, PART-III								
LECTURER: PARTHA CHANGDAR								
F.M.- 100			INTERNAL-30		ESE- 70			
GROUP /UNIT	Day	TOPIC COVERED			OUTCOME			
					OBJECTIVE	INPUT	LEARNING OUTCOME	GOOGLE ATTENDANCE
1.1	1	UNIT 1 (Microprocessor Basics)	Generation and evolution of 4 bit microprocessor to latest microprocessor		introduction of microprocessor	generation & evolution of processor & microprocessor	defination of microprocesor, comparison etc	
1.2	2		**Basic Architecture of 8-bit Microprocessor** 1.2.1 Hardware features of		internal architecture of 8085 microprocessor	architecture, pin configuration of 8085 microprocessor	IC details, bus structure, functional units	
	3		1.2.4 Interrupts 1.2.5 Pin description.		pin description of 8085	8085 pin diagram	level of interrupts, 40 pins details discusion	
1.3	4		Timing cycles of 8085 – Machine cycle, Opcode fetch cycle, execution cycle, instruction cycle.		timing diagram of 8085	instruction cycle, machine cycle, t state	opcode fetch, I/O read timing diagram	
	5					memory read/write operation	timing diagram of any instruction	
contd..	6		**Revision Class and Q/A Discussion**					
	7		**Revision Class and Q/A Discussion**					
2.1	8	UNIT 2 (Microprocessor Programming)	Instruction set of Intel 8085		instruction set	classification of instruction set	instruction set based on functionality, data length etc	
2.2	9		Addressing modes		addressing mode	operand addressing	discussion on various types of addressing modes	
2.3	10		Introducing to branch and subroutine		branching and subroutine	branching instruction	conditional & unconditional branching	
2.4	11		Simple Program such as Addition, Subtraction, Multibyte		programming	various 8/16 bit programming	addition, subtraction, multiplication of two 8/16 bit number	
	12		addition, Multiplication of two numbers, BCD to Hex conversion, Hex to BCD conversion etc					
2.5	13		Interrupt & Interrupt Service Routine		interrupts	5 levels interrupts	maskable,non maskable, hardware,software interrupts etc	
contd..	14		**Revision Class and Q/A Discussion**					
3.1	15	UNIT 3 (Application of microprocessor)	Review of A/D and D/A converter		peripheral device	ADC & DAC	pin configuration and explanation	
3.2	16		Interfacing – parallel (8255)		8255	programmable peripheral interface	pin details and explanation	
3.3	17		Measurement of voltage, current, frequency		application of microprocessor in different electrical fields	measurement procedure of voltage, current, frequency using microprocessor	block diagram and proper explanation	
3.4	18		Measurement of voltage, current, frequency					
3.5	19		Over current Relay operation .			operating relay using 8085	relay and their different types, flow chart	

3.6	21		Speed control of D.C. motor		controlling speed of DC motor	technique and explanation	
4.1	22	UNIT 4 (Microcontroller Basics)	Introduction and applications	introduction of 8051	overview 0f 8051 and application	basic idea about 8051 and need of microcontroller	
4.2	23		Comparison between microcontrollers and microprocessors	comparison	microprocessor, microcontroller, microcomputer	defination, clarification, differentiate	
4.3	24		Evolution of microcontrollers	evolution of microcontroller	generation of microcontroller	history of microcontroller	
4.4	25		Architecture of 8051	internal architecture of 8051	block diagram of 8051	various functional unit of 8051 and explanation	
4.4.1	26		Block diagram of 8051 microcontroller Registers in 8051 General purpose or working registers	details about 8051 microcontroller	ic diagram of 8051	pin description of 8051	
4.4.2	27				pin layout	ic configuration and signal group of 8051	
4.4.3	28				various general purpose register	working & need of general purpose register	
4.4.4	29	contd...	Stack Pointer and Program counter	functional unit of 8051 microcontroller	explanation of individual units	stack pointer, special function registers, program status word, data pointer, timer register various ports and control registers etc.	
4.4.5			Special function registers (SFR)				
4.4.6	30		Program Status word				
4.4.7	31		Data pointer (DPTR)				
4.4.8	33		Timer resisters,Ports, Control registers				
	34						
ontd..	35		**Revision Class and Q/A Discussion**				
5.1	37	UNIT 5 (8051 addressing modes and instructions)	8051 addressing modes	addressing mode	operand addressing of 8051	six various types addressing modes and their explanation	
5.2	38		8051 instruction set	instruction set	classification of instruction set of 8051	data transfer, arithmetic , logical,program branch, bit processing group	
5.3	39		8051 Simple Program such as Addition, Subtraction, Multi-byte addition, Multiplication of two numbers, BCD to Hex conversion, Hex to BCD conversion, Hex to ASCII conversion etc.	programming	programming using 8051	various simple program such as Addition, Subtraction, Multi-byte addition, Multiplication of two numbers, BCD to Hex conversion, Hex to BCD conversion, Hex to ASCII conversion	
	40						
	41						

6.1	42	UNIT 6 8051 interrupts	Interrupts in 8051	interupts of 8051	five interrupts signal	INT0,TF0,INT1,TF1,R1/T1, and individual explanation	
6.2			Initializing 8051 interrupts		interupt enable register		
6.3	43		Interrupt priorities		interrupt priority register,		
6.4	44		Timers and counters, timer counter modes		TCON register		
7.1	45	Unit 7 (App of MC)	Measurement of voltage, current, frequency.	need and importance of microcontroller	measurement of voltage current,frequency using 8051	procedure, operation technique, flow chart and their illustration	
7.2	46		Generation of square, triangular and staircase waveform.		Generation of square, triangular and staircase waveform.		
7.3	47		Over current Relay operation		over current relay operation using 8051		
7.4	48		Speed control of D.C. motor.		control of DC motor using 8051		
contd..	49	**Revision Class and Q/A Discussion**		previous year question & answer discusion	various reference book, question bank, online study, matrix		
	50	**Revision Class and Q/A Discussion**					

Prepared by

Partha Changder

Name of the Subject : Power Electronics & Drives **External Marks:**

Course Code : EE/S5/PED **Internal Marks : 25**

SL NO	SUBJECT	EXPERIMENT NAME	DATE	DEMONSTRATION	google attendance
1	Power Electronics & Drives	ate an op-amp integrator, determine its amplitude, phase relation with input,		OP-amp integrator	
2		2. To fabricate an op-amp differentiator, determine its amplitude, phase relation with input duration of		OP-amp	
3		3 To identify the terminals of Thyristor and plot V-I characteristics of Thyristor		thyrister	
4		4 To fabricate with IC-555 - (a) Astable multivibrator & to determine duration of high pulse, low pulse and duty cycle. (b) Monostable multivibrator & to determine the duration of high and low pulses triggered condition with different R-C values. (c) A Pulse Width Modulation circuit to observe the variation of duration of high pulse with the various values of control voltage at control input terminal of IC-555.		USING IC555	
5		5 To study fully controlled full wave rectifier using SCR.).		USING SCR	
6		6. To study DC chopper circuit using SCR).		CHOPPER USING SCR	
7		7 To study series inverter using SCR		INVERTER	
8		8. To perform speed control of DC series motor using SCR.		DC SERIES MOTOR	
9		9. To perform speed control of 3-phase Induction motor using PWM inverter. Interpret speed-torque characteristics. Use variable voltage variable frequency drive		PWM INVERTER	
10		10.To study the operation and circuit diagram of Uninterrupted Power Supply unit		UNINTERRUPTED POWER SUPPLY	

prepared by

Fakruddin khan

Name of the Subject : Switchgear & Protection Course Code : EE/S5/SGP					External Marks:25 Internal Marks : 25
SL NO	**SUBJECT**	**EXPERIMENT NAME**	**DATE**	**DEMONSTRATION**	**google signature**
1	**Switchgear & Protection**	Test the different types of relays		types of relays	
2		Identify different types of circuit breakers		circuit breakers	
3		Idea about simulation		about simulation	
4		Set the relays for various tests		relays for various tests	
5		To demonstrate HRC fuse, MCB & ELCB and explain the functions of various components		HRC fuse, MCB & ELCB	
6		To identify the components of following types of circuit breakers with their specifications (through visits , video or model).: I) Low tension air circuit breaker. II) Minimum oil circuit breaker (M O C B) Blast circuit breaker (ABCB) ber - Hexa fluoride circuit breaker (S F 6)		Minimum oil circuit breaker, Air Blast circuit breaker,. Vacuum circuit breaker.	
7		To calculate the Total Cost in a (i) Residential and (ii) Commercial or Industrial Bill.		calculate Industrial Bill.	
8		To test percentage Differential Protection of Transformer Using Transformer Differential Relay (Electromagnetic/Microprocessor based)		Using Transformer Differential RELAY	
9		To test Directional Over Current Relay (DOCR) by Relay Testing Kit		Directional Over Current Relay KIT	
10		To prepare a report on specifications of lightning arresters of different manufacturers through Brochures / Literature		prepare a report different lightning arresters	

Prepared By-- Arka Ghosal;Lecturer in EE

Name of the Subject : Energy Conservation & Audit
Course Code : EE/S5/ECA(EL)

External Marks : 25
Internal Marks: 25

Sl No.	Name of the Chapter	Name of the Topic	Date	Demonstration	google attendance
1	Energy Conservation & Audit	To save energy by using electronic ballast as compared to conventional choke		electronic ballast,and conventionl chock	
2		To Collect the Standard tariff rates and suggest suitable tariff for given industry/Lab/Institute/Commercial establishment..		Standard tariff rates	
3		To make a survey of one establishment to identify different methods used for energy conservation.		make a survey	
4		To prepare Energy audit report for Industry/workshop/ Institute		Energy audit report for Industry	
5		To search on the website of power ministry and collect the information regarding role of energy manager, energy auditor and prepare power point		search on the website of power ministry, prepare power point	
6		To list energy saving equipments for domestic and commercial applications		list energy saving equipments	
7		To list the different equipments used in energy auditing		list the different equipments energy auditing	

prepared by
sounyadeep dogra

Name of the Subject : utilization,traction,heating & drives **External Marks: 25**

Course Code : EE/S5/UTHD **Internal Marks : 25**

SL NO	SUBJECT	EXPERIMENT NAME	DATE	DEMONSTRATION	GOOGLE SIGNATURE
1	utilization,traction,heating & drives	1. To determine Illumination of a surface for a Drawing Room by means of lux meter.		using lux meter	
2		2 To determine candle power of a lamp in comparison to standard C.P. of lamp by optical bench method.		using optical bench method	
3		3 To verify the Inverse Square Law and compare the difference in output luminescence of incandescent, fluorescent and compact fluorescent lamps.		fluoresent lamps	
4		4 To Study of Sodium vapour lamp, Mercury vapour lamp, CFL with their connections and the technical specification.		sodium vapour lamp	
5		5 To study of torques/Armature current, Speed/Armature current & Torque/Speed characteristics for D.C. series motor using mechanical loading. (Either braking arrangement or using D.C.Gen).		DC series motor	
6		6. To study of different current collectors used for drawing current from O.H. system for traction (using models and block diagram).		using drawing current from Ohsystem	
7		7 To calculate the Total Cost in a (i) Residential and (ii) Commercial or Industrial Bill.		calculate industrial bill	
8		8. To study of Electric Arc Welding using welding transfor		welder transfoemer	
9		9. To study of the principle of Induction Heating using an i		induction heater	
10		10. To Study Electricity Act 2003 : Energy Audit, role of energy manager, energy auditor and prepare power point presentation/report.		prepare report	

Prepared by

pravat khanra & amit mukherjee