2023-24

B.Tech. (ODD SEMESTER) EXAMINATION

(ELECTRICAL ENGINEERING)

AUTOMATION & CONTROL

(EEA-3010)

Max Marks: 60 Duration: 2 Hours

Note: *Answer the following questions.*
Assume suitable data if missing.
Notations used have their usual meaning.
Use graph/semi-log graphs in suitable questions.

Q. No.	Question	CO	M.M.
1 (a)	With the help of suitable diagram, explain briefly the operation of Synchro pair as error detector	CO1	06
	OR		
1(a')	Explain the construction and working principle of AC servomotor. Draw its torque speed characteristics.	CO1	06
1 (b)	Derive the transfer function $e_o(s) / e_{in}(s)$ for the circuit shown in the Fig. 1(b).	CO1	05

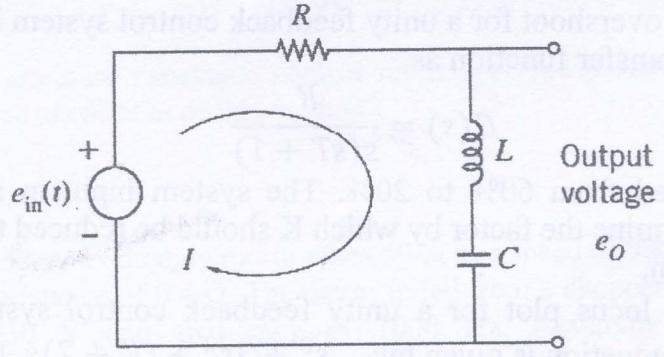


Fig.1(b).

1 (c)	Using an appropriate illustration, describe the mathematical modelling for force-voltage analogy.	CO1	04
2 (a)	State any six rules for block diagram reduction technique.	CO2	06
	OR		
2 (a')	Define the Controllability and Observability of a control system. Explain the method for checking the controllability and observability.	C02	06

Contd.... 2.

2 (b) Reduce the block diagram shown in Fig.2(a). and obtain C(s) / R(s) CO2 **09**

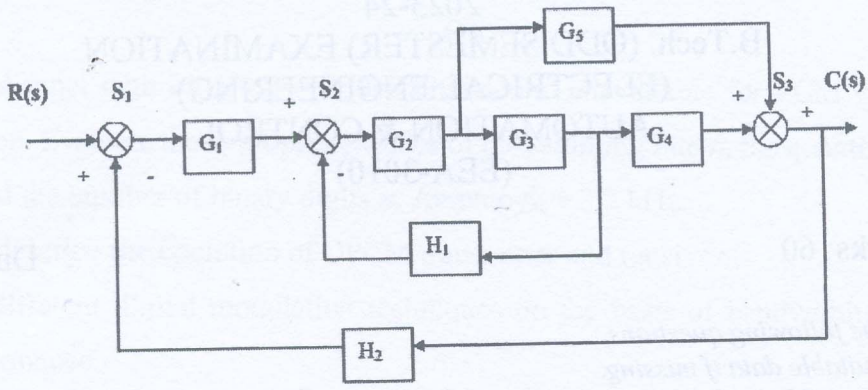


Fig.2(a)

OR

2 (b') Using Mason's gain formula, find the transfer function C(s)/R(s) for the system shown below in Fig.2(a') CO2 **09**

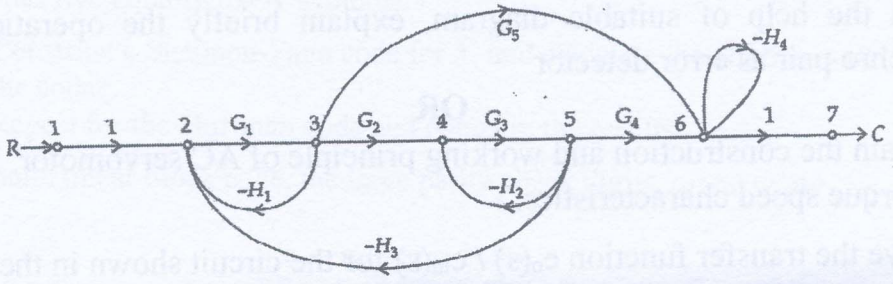


Fig.2(a')

3 (a) The maximum overshoot for a unity feedback control system having its forward path transfer function as CO3 **08**

$$G(s) = \frac{K}{s(sT+1)}$$

is to be reduced from 60% to 20%. The system input in a unit step function. Determine the factor by which K should be reduced to achieved above reduction.

3 (b) Draw the root locus plot for a unity feedback control system whose characteristics equation is given by: $s^3 + 3s^2 + (K+2)s + 5K = 0$ CO3 **07**

OR

3 (b') A unity feedback control system is characterized by open loop transfer function CO3 **07**

$$G(S) = \frac{K(s+13)}{s(s+3)(s+7)}$$

Using Routh criterion, Calculate the range of values of K for system to be stable.

4 (a) Define resonant peak (M_r) and resonant frequency (ω_r). CO4 **03**

4 (b) Sketch the Bode plot for the transfer function. CO4 **12**

$$G(S) = \frac{50}{s(1+0.25s)(1+0.1s)}$$

Determine (i) Gain crossover frequency, (ii) Phase crossover frequency, (iii) GM and P.M, (iv) Stability of the given system.

2023-24
B.TECH. (ODD SEMESTER) EXAMINATION
ELECTRICAL ENGINEERING
ELECTRICAL DRIVES
EEC3110

Maximum Marks: 60 **Credits: 04** **Duration: Two Hours**

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meanings.

Q.No.	Question	M.M.	CO
1(a)	Explain the working of a hoist for the following operations: (i) Lifting an empty cage (ii) Lowering an empty cage In which quadrant of speed-torque plane does the motor operate for the above operations?	[07]	CO1
1(b)	Differentiate between short-time duty and intermittent duty loads. Derive expression for overloading factor for short-time duty load.	[08]	CO1
2(a)	Explain plugging method of braking used for separately excited DC motor.	[08]	CO2
	OR		
2'(a)	Explain field armature resistance control method of speed control of a dc motor. What are drawbacks of this method?	[08]	CO2
2(b)	A 230 V separately excited dc motor takes 50 A at a speed of 900 rpm. It has an armature resistance of 0.4 Ω. The motor is fed from a chopper with source voltage of 230 V and frequency of 1000 Hz. Assuming continuous conduction (i) Calculate the motor speed for motoring operation for duty ratio of 0.5 at the rated torque. (ii) Calculate the motor speed for braking operation for duty ratio of 0.6 at half the rated torque.	[07]	CO2
3	Explain why the stator voltage needs to be varied if frequency is varied for speed control below the rated speed of an induction motor. Whether the voltage will be varied if frequency is increased above the rated speed? Justify your answer.	[15]	CO3
4(a)	With the help of a schematic diagram explain the working of the static rotor resistance control method of speed control of a wound rotor induction motor.	[7]	CO4
4(b)	Explain the static Kramer's drive used for speed control of induction motor.	[8]	CO4

2023-2024 (6562)

B.Tech. (ODD SEMESTER) EXAMINATION
(ELECTRICAL ENGINEERING)
POWER ELECTRONICS-II
(EEC3210)

Maximum Marks: 60 **Credits: 04** **Duration: Two Hours**

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q. No.	Questions	M.M.	COs
1(a)	A boost converter is shown in the Figure 1. If V_{in} = 20V, V_0 = 60 V, R = 60 Ω, L = 30 μH and D (duty cycle) = 0.5, Then the converter will operate at a switching frequency of (in kHz) approx. _____.	(8)	CO-1

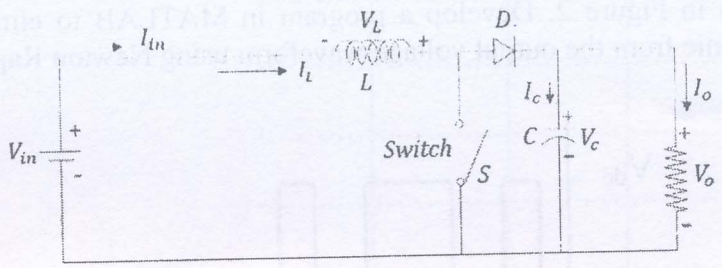


Figure 1

1(b)	An ideal boost converter is feeding a resistive load of 50 Ω at 50 $Volts$. The input supply voltage is 20 Volts. The duty ratio of operation is 0.5. The Inductance is 20μH. Calculate the frequency at which the switch is operating.	(7)	CO-1
2	Draw the circuit diagram for a three phase ac regulator feeding a delta connected balanced R load. Develop the conduction table and draw the output voltage waveform for any one phase for a firing angle α = 120° on the sheet provided.	(15)	CO-2
	OR		
2'	Draw the circuit diagram for a three phase ac regulator feeding a star connected balanced R load. Develop the conduction table and draw the output voltage waveform for any one phase for a firing angle α = 30° on the sheet provided.	(15)	CO-2
3	Obtain and draw the Line and Phase output voltage waveform for a three phase inverter feeding a star connected R-load operating in 180° conduction mode. Also obtain the THD of the Line and phase voltage.	(15)	CO-3
	OR		

contd....2

3'(a)	A single PWM inverter feeds an RL load with R= 10 Ω and L= 20 mH. If the source voltage is 120 Volts, find the total harmonic distortion in the load current. The width of each pulse is 120° and the output frequency is 50 Hz.	(7)	CO-
3'(b)	A single-phase, half bridge inverter feeds a resistive load (R= 10 Ω). If the source voltage is 240 Volts, determine A) The rms value of fundamental component of output voltage B) The output power C) The peak off-state voltage across each semiconductor switch D) The lowest order harmonic and the corresponding harmonic factor	(8)	CO-
4(a)	A 1-phase voltage source inverter is controlled in a single pulse width modulation mode with a pulse width 2d=150° in each half cycle. Calculate the total harmonic distortion of output ac voltage waveform in %.	(5)	CO-
4(b)	Obtain the Selective Harmonic Elimination Equations for the output voltage shown in Figure 2. Develop a program in MATLAB to eliminate 5^{th} and 7^{th} harmonic from the output voltage waveform using Newton Raphson Method.	(10)	C0-4

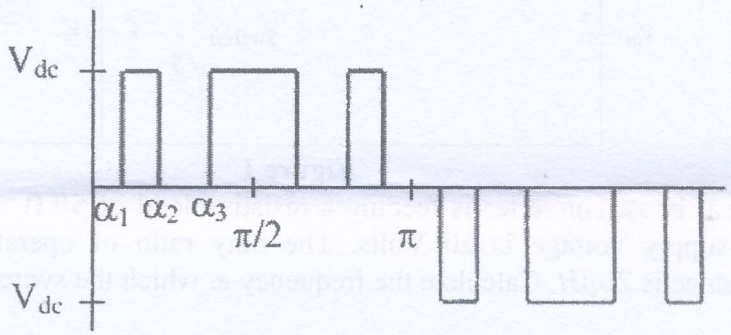


Figure 2

contd....3.

Three phase waveform sheet

-3-

6562

2023-2024 (6563)

B.TECH. (ODD SEMESTER) EXAMINATION
(ELECTRICAL ENGINEERING)
NEW AND RENEWABLE ENERGY SOURCES
(EEC3220)

Maximum Marks: 60 **Credits: 04** **Duration: Two Hours**

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q. No.	Questions	CO	MM
1(a)	Mention four major disadvantages of conventional sources of energy?	CO1	[04]
1(b)	Discuss trade-off between energy and environment.	CO1	[05]
1(c)	Draw spectral power distribution curve of terrestrial solar radiation and highlight its main features.	CO1	[06]
2(a)	What is the usefulness of a maximum power point tracker in a solar PV system?	CO2	[07]
2(b)	Derive a simple mathematical model of an ideal solar cell. Correlate the open circuit voltage with band gap of the material.	CO2	[08]
	OR		
2(b')	With the help of neat diagram explain main features of three types of solar collectors.	CO2	[08]
3(a)	Explain the following terms with reference to biomass energy generation i) Pelletization ii) Pyrolysis	CO3	[05]
3(b)	Calculate the volume of cow dung based biogas plant required for cooking needs of a family of five adults and lighting needs with two 100 CP lamps for three hours daily. Also calculate the required number of cows to feed the plant. Assume Biogas requirement for cooking= 0.227 $m^3/person/day$ Gas required for lighting= 0.126 $m^3/hour$ The density of slurry= 1090 Kg/m^3 Collectable cow dung= 70 % Dry weight of solid mass= 18%	CO3	[10]
4(a)	Discuss the pitch and yaw control system of a wind turbine.	CO4	[08]
4(b)	State and derive the *Betz* criterion for maximum power extraction	CO4	[07]

contd ....2.

OR

4'(a) Draw and mention the various regions of operation in the power-speed characteristics of a wind turbine. CO4 [05]

4'(b) A propeller type wind turbine has the following data: CO4 [10]

Speed of wind at a height (H) of 10 m= 12 m/s
Air density= 1.226 Kg/m^3
Height of tower= 100 m
Wind velocity at turbine reduces by 20%
Generator efficiency= 85 %
Wind speed at a height h is given by

$$u_h = u_H\left(\frac{h}{H}\right)^{\alpha}$$

Where α = 0.14 and u_H is the wind speed at reference height H=10 m.
Find

i) Total power available in wind
ii) Power coefficient
iii) Power extracted by the turbine
iv) Electrical Power generated

Paper Code 6564

2023-2024

B.Tech (ODD SEMESTER) EXAMINATION

(ELECTRICAL ENGINEERING)

POWER SYSTEM ANALYSIS

(EEC3310)

Max. Marks 60 Duration 2 Hours

Note: Attempt all questions
Assume suitable data if missing
Notations used have their meaning

Q.No		Questions	CO	MM
1(a)	i.	What is single line diagram ?	CO1	6
	ii.	Why do we go for iterative methods to solve the load flow problem ?		
	iii.	Discuss the effect of acceleration factor in load flow study.		
	iv.	What is the importance of acceleration factor in GS power flow analysis?		
		OR		
(a')		Give a flow chart for load flow study using Newton Raphson method. How does the method gets modified to account for PV buses?	CO1	6
(b)		Figure 1 shows the one line diagram of a simple three bus power system with generation at buses 1 and 3. The magnitude of voltage at bus 1 is V = 1.05 $\angle 0^{o}$ per unit. Voltage magnitude at bus 3 is fixed at 1.04 pu with a real power generation of 200MW. A load consisting of 400 MW and 250 MVAR is taken from bus 2. Line admittances are marked in per unit on a 100 MVA base. For the purpose of load calculations, line resistances and the charging susceptances are neglected. Obtain the power flow solution using the fast decoupled algorithm.	CO1	9
2 (a)		The incremental costs in Rs per MW-hour of two 250 MW units are $dC_1/dP_1 = 0.2P_1 + 30$ $dC_2/dP_2 = 0.15P_2 + 40$. The minimum load of each is 20 MW. Find the load division between the two units as the total load varies from 40MW to 500 MW.	CO2	8
(b)		Compute the saving per year for economical load allocation compared to equal load sharing for a total system load of 225 MW for the unit of part (a) above. Assume that the system load remains constant throughout the year.	CO2	7
3(a)		The two bus system is shown in Figure 2. Determine the total three phase fault current and the fault current supplied by each generator at the faulted point.	CO3	8
(b)		A 30 MVA, 11 kV, three phase synchronous generator has a direct subtransient reactance of 0.25 p.u. The negative and zero sequence reactances are 0.35 and 0.1 p.u. respectively. The neutral of the generator is solidly grounded. Determine the subtransient current in the generator	CO3	7

Contd ....2.

and the line to line voltages for subtransient conditions when a single line to ground fault occurs at the generator terminals with the generator operating unloaded at rated voltage.

OR

(b') A transmission line of inductance 0.1 H and resistance 5 Ω is suddenly short circuited at t= 0 as shown in Figure 3. Write the expression for short circuit current i(t). Find approximately the value of the first current maximum Find the approximate value of the first current maximum for the given values of α and θ. What is this value for $\alpha = 0^0$, and $\theta = 90^0$? What should be the instant of short circuit so that the DC offset current is (i)zero and (ii)maximum ?. CO3 7

4(a) A generator with constant excitation supplies 30 MW through a step up transformer and a high voltage line to an infinite busbar. If the steady state stability limit of the system is 60 MW, estimate the maximum permissible sudden increase of generator output if the stability is to be maintained. The resistances of the generator, transformer and line may be neglected. CO4 8

(b) For a single machine connected to infinite bus, derive the condition for steady state stability CO4 7

(b') A synchronous generator of reactance 1.20 pu is connected to an infinite bus bar (|V| = 1.0 pu) through transformers and a line of total reactance of 0.60 p.u. The generator no load voltage is 1.20 pu and its inertia constant is H = 4 MW-s/MVA. The resistance and machine damping may be assumed negligible. The system frequency is 50 Hz. Calculate the frequency of natural oscillations if the generator is loaded to CO4 7

i. 50% and
ii. 80% of its maximum power limit

contd ....3.

6564

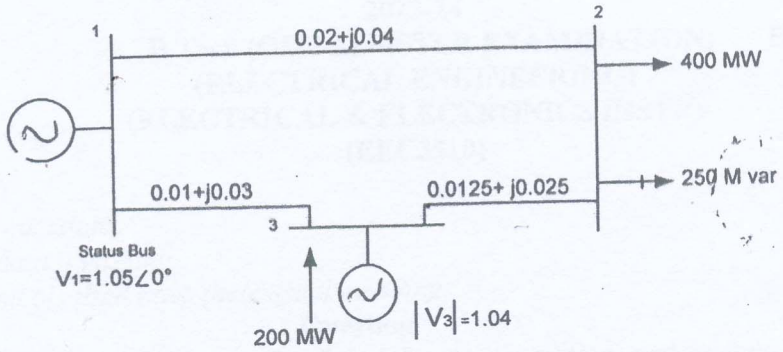


Fig. 1

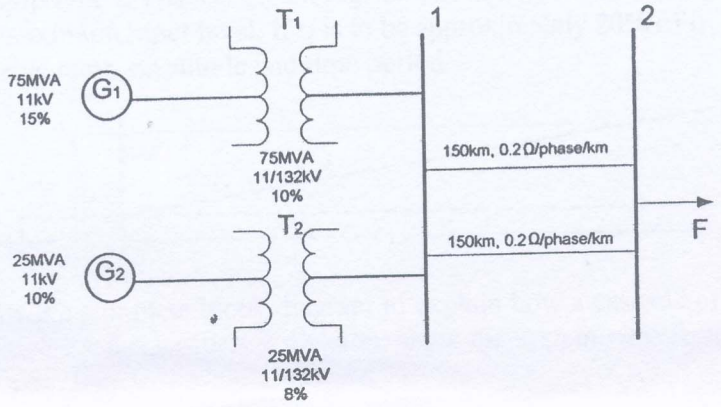


Fig. 2

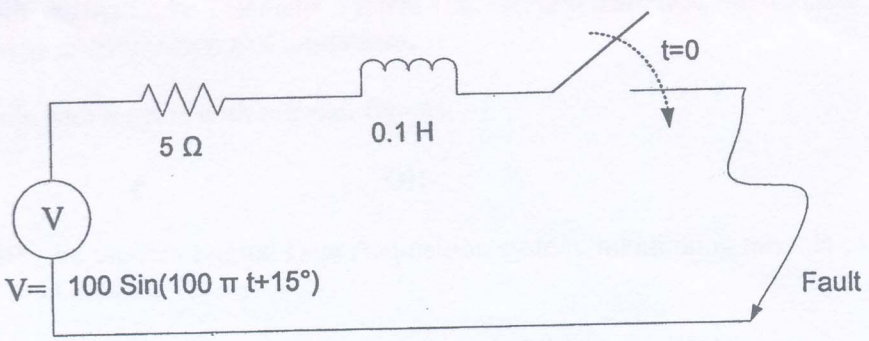


Fig. 3

2023-24

B.Tech (ODD SEMSTER EXAMINATION) **Paper Code: 6565**

(ELECTRICAL ENGINEERING)

(ELECTRICAL & ELECTRONICS INSTR)

(EEC3510)

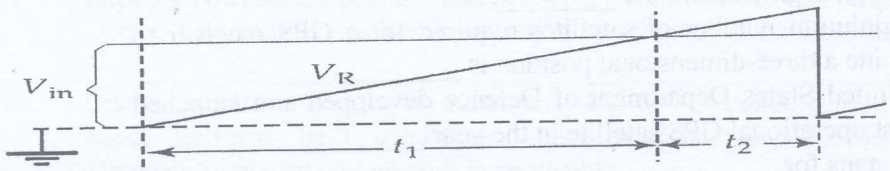
Max Marks : 60 Duration: 2 Hours

Note: *Answer all questions.*

Assume suitable data if missing.

Notations and symbols used have their usual meaning.

Q.No.	Question	CO	M.M.
1(a)	Discuss the errors that occur in digital frequency meters, and explain the method of specifying the measurement accuracy.	(CO1)	[05]
1(b)	A ramp-type DVM has a 5-bit register ADC, a 200 kHz clock generator and a 5V maximum input level. If t_2 is to be approximately 20% of t_1, determine the suitable ramp amplitude and time period.	(CO1)	[05]



1(c)	Draw the complete block diagram to explain how a cascade of flipflops may be used for the frequency division, show the system waveforms and explain its operation.	(CO1)	[05]
2(a)	Explain the fundamental principles of operation behind a Digital Storage Oscilloscope. How does it differ from an analog oscilloscope?	(CO2)	[08]
	OR		
2(a')	Explain the hydraulic Telemetry System with relevant diagrams, highlighting the areas of application and limitations.	(CO2)	[08]
2(b)	Explain data loggers with relevant figures.	(CO2)	[07]
	OR		
2(b')	Explain the modern Digital Data Acquisition system, mentioning the role of important blocks.	(CO2)	[07]
3(a)	Explain, with the help of a diagram, the construction and characteristics of a Piezoelectric transducer; derive the output voltage equation.	(CO2)	[08]

Contd ... 2.

3(b)	Describe two temperature measurement transducers along with their general equations and limitations.	(CO3)	[07]

OR

3(b')	Explain three digital transducers.	(CO3)	[07]
4(a)	a) The three main segments of the GPS system are the space segment, the control segment, and the _____. b) The minimum number of satellites required for a GPS receiver to determine a three-dimensional position is _____. c) The United States Department of Defence developed and launched the first operational GPS satellite in the year _____. d) LIGA stans for _____. e) MEMS fabrication process include _____& _____& _____.	(CO4)	[07]
4(b)	Describe briefly about (ANY TWO) of the following a) Wide Area Measurement b) Nano Instrumentation c) Virtual Instrumentation d) Intelligent instrumentation.	(CO4)	[08]

Paper Code: 6566

2023-2024
B.Tech. (ODD SEMESTER) EXAMINATION
(ELECTRICAL ENGINEERING)
HIGH VOLTAGE ENGINEERING
(EEC3610)

Max Marks: 60
Duration: 2 Hours

Note: Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No	Questions	M.M	CO
1(a)	Explain Townsend's primary and secondary ionization coefficients. And Derive Townsend's breakdown equation in gases under uniform fields.	6	CO1
1(b)	Discuss streamer theory with suitable figures for the breakdown in gases under uniform field conditions. Also, explain the limitations of Townsend's theory and when it is applicable.	7	CO1
1(c)	Explain the cavitation and bubble theory for breakdown in liquid dielectrics. And explain the effect of moisture content on the breakdown strength of liquid dielectrics.	7	CO1
1'(c)	Explain the electrochemical deterioration and breakdown due to tracking and treeing in solid dielectrics with the help of diagram. Also draw the curve showing the variation of breakdown strength with time for solid dielectrics.	7	CO1
2 (a)	Give reasons for the following (In brief) (i) Cascading of testing transformer is restricted to with in 5 units. (ii) Cockcroft Walton circuit preferred for voltage multiplier circuits	5	CO2
2 (b)	With the help of a neat sketch explain Van-de Graff generator for generating high voltages. What are the limitations of this method.	8	CO2
2'(b)	Explain Multi-stage Impulse Generators- Marx circuit with the help of a diagram. And, Derive the expression for a double exponential wave using the single stage circuit for Impulse generator.	8	CO2
2 (c)	A Cockcroft Walton type voltage multiplier circuit has eight stages with capacitances, all equal to 0.05 μF. The supply transformer secondary voltage is 125 kV at a frequency of 150 Hz. If the load current to be supplied is 5 mA, find (i) The percentage ripple (ii) the regulation, and	7	CO2

contd....2.

	(iii) the optimum number of stages for minimum regulation or voltage drop.		
3 (a)	Explain with help of figures the working of Generating voltmeters for the measurement of high dc voltages. What are its advantages and limitations?	8	CO3
3(a')	With suitable diagrams explain the principle of measurement of High Alternating Voltages using the sphere gap method. State all the factors that affect the AC voltage measurement and how are they incorporated.	8	CO3
3 (b)	With the help of a neat circuit diagram explain the Chubb-Fortescue method for the measurement of peak value of ac voltage. State its advantages over other methods.	6	CO3
3 (c)	Explain measurement of ac voltages by Electrostatic voltmeters with the help of a diagram.	6	CO3
3(c')	A generating voltmeter has to read 250 kV with an indicating meter having a range of (0-20 μA) calibrated accordingly. Calculate the capacitance of the generating voltmeter when the driving motor rotates at a constant speed of 1500 rpm.	6	CO3

2023-24

B. TECH. (ODD SEMESTER) EXAMINATION

ELECTRICAL ENGINEERING

FUNDAMENTALS OF COMMUNICATION ENGINEERING

ELA 3020

Maximum Marks: 60 **Credits: 04** **Duration: Two Hours**

Answer all questions.
Assume suitable data if missing.
Notations and symbols used have their usual meaning.

Q.No.	Question	CO	M.M.
1(a)	The Antenna current of an AM broadcast transmitter, modulated to a depth of 40 percent by an audio sine wave, is 11A. It increases to 12 A as a result of simultaneous modulation by another audio sine wave. What is the modulation index due to this second wave?	(CO1)	[7]
	OR		
1(a')	Derive the formula for the instantaneous value of FM voltage and define modulation index.	(CO1)	[7]
1(b)	A 25 MHz carrier is modulated by a 400 Hz audio sine wave. If the carrier voltage is 4V and the maximum frequency deviation is 10 KHz and phase deviation is 25 radians, write the equation for this modulated wave for FM and PM. If the modulating frequency is now changed to 2 KHz, all else remaining constant, write a new equation for FM and PM	(CO1)	[8]
2(a)	The T1 carrier system used in digital telephony multiplexes 24 voice channels based on 8 bit PCM. Each voice signal is usually put through a low pass filter with the cut off frequency of about 3.4 KHz. The Filtered voice signal is sampled at 8 KHz. In addition, a single bit is added at the end of the frame for the purpose of synchronization.	(CO2)	[6]

Calculate:

i) The duration of each bit.

ii) The resultant transmission rate.

contd... 2.

OR

2(a') A binary channel with bit rate r = 36000 bits/second is available for PCM voice transmission. Evaluate the appropriate values of the sampling rate f_s, the quantizing level L, and the number of binary digits n. Assume f_m = 3.2 kHz. (CO2) [6]

2(b) Draw and describe the operation of DPCM transmitter and receiver. (CO2) [6]

2(c) Compare different digital modulation techniques on the basis of bandwidth and error performance. (CO2) [5]

3(a) For a DMS, there are 3 symbols with probability $P_1=\beta$ and $P_2 = P_3$. Determine the entropy of the source and sketch its variation for different values of β. (CO3) [8]

OR

3(a') A DMS 'X' has five equally likely symbols. (CO3) [8]

i) Construct a Shannon-Fano code for X, and calculate the efficiency of the code.

ii) Repeat for the Huffman code and compare the results.

3(b) For a systematic linear block code, the three parity check digits, c_4, c_5, c_6 are given by (CO3) [7]

$$c_4 = m_1 \oplus m_2 \oplus m_3$$
$$c_5 = m_1 \oplus m_2$$
$$c_6 = m_1 \oplus m_3$$

i) Construct the generator matrix.

ii) Determine all the codewords generated by this matrix.

4(a) What is cell splitting? Derive an expression which shows that transmitter power for base station of small sized cell or, microcell is reduced by 12 dB. (CO4) [8]

4(b) Classify the optical fibre on the basis of modes of propagation. (CO4) [5]