BABU BANARASI DAS UNIVERSITY LUCKNOW

SCHOOL OF ENGINEERING

Syllabus for

Bachelor of Technology

in

Electronics & Communication Engineering

(Effective from the Academic Session 2012-13)

COURSE STRUCTURE- B.Tech-2nd year
(Electronics & Communication Engineering)

2nd – YEAR SEMESTER-III

Sl.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credits
			L	T	P	Sessional Exam.			ESE		
						CT	TA	Total			
1.	BHU – 301/ BHU – 302	Industrial Psychology/ Industrial Sociology	2	0	0	15	10	25	50	75	2
2.	BAS – 302	Numerical Technique	2	1	0	15	10	25	50	75	3
3.	BEC – 301	Digital Electronics	3	1	0	30	20	50	100	150	4
4.	BEC– 302	Semiconductor Material & Analog Circuits	3	1	0	30	20	50	100	150	4
5.	BEC – 303	Networks Analysis &Synthesis	3	1	0	30	20	50	100	150	4
6.	BCS – 305	Programming in 'C'	3	1	0	30	20	50	100	150	4
Practical / Training / Project											
7.	BEC – 351	Digital Electronics Lab	0	0	2	10	10	20	30	50	1
8.	BEC – 352	Electronics Lab	0	0	2	10	10	20	30	50	1
9.	BEC – 353	Networks Lab	0	0	2	10	10	20	30	50	1
10.	BCS – 355	'C' Programming Lab	0	0	2	10	10	20	30	50	1
11.	GP– 301	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**16**	**5**	**8**	**Total**				**1000**	**26**

2nd – YEAR SEMESTER-IV

Sl.No.	Course Code	Subject	Periods			Evaluation Scheme				Subject Total	Credits
			L	T	P	Sessional Exam.			ESE		
						CT	TA	Total			
1.	BHU – 402/ BHU – 401	Industrial Sociology/ Industrial Psychology	2	0	0	15	10	25	50	75	2
2.	BAS – 401	Mathematics-III	3	1	0	30	20	50	100	150	4
3.	BEC –401	Advance Analog Circuits	3	1	0	30	20	50	100	150	4
4.	BEC – 402	Electronic Measurements & Instruments	3	1	0	30	20	50	100	150	4
5.	BEC–403	Electromagnetic Theory	3	1	0	30	20	50	100	150	4
6.	BEC– 404	Signals and Systems	3	1	0	30	20	50	100	150	4
Practical / Training / Project											
7.	BEC – 451	Advance Analog Circuits Lab	0	0	2	10	10	20	30	50	1
8.	BEC – 452	Electronic Measurements & Instruments Lab	0	0	2	10	10	20	30	50	1
9.	BEC – 453	Electronics Workshop & PCB Lab	0	0	2	5	5	10	15	25	1
10.	GP – 401	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**17**	**5**	**6**	**Total**				**1000**	**26**

BEC–301: DIGITAL ELECTRONICS

Unit-1 Number Systems: Decimal, Binary, Octal and Hexadecimal systems, conversion from one base to another, Codes-BCD, Excess- 3, Gray Reflected ASCII, EBCDIC.

Unit-2 Algebra for logic circuits: Logic variables, Logic constants, Logic functions, NOT, AND, OR, NAND, NOR, Ex-OR, Boolean Algebra (including Shanon's expansion theorem and consensus theorem), Canonical representations-min-term, max-term, Karnaugh map simplification, Quine-McCluskey minimization.

Families of logic circuits: Transistor inverter, RTL, Diode logic, DTL,TTL, Brief introduction to DCTL,IIL,HTL,ECL and MOS gates.

Unit-3 Combinational circuits: Analysis and synthesis of combinational circuits, Multiplexer, Demultiplexer, Encoder, Decoder, Code-converter, Adder, Subtractor, 2' complement Adder cum Subtractor, Carry look-ahead adder, Comparator, Parity generator/checker, Priority encoder.

Unit-4 Sequential Circuits: Flip-flops- SR, JK, D and T, Registers- Buffer registers, shift registers etc. Counters- Asynchronous and synchronous counters, Basic models of sequential M/C, Analysis of asynchronous and synchronous circuits, Synthesis of completely and incompletely specified synchronous sequential M/Cs, State M/Cs.

Unit-5 Interface circuits: PLD, RAM, ROM memories, Design of register transfer logic, ASM design with example, asynchronous sequential logic.

Text/Reference Books:

1. Malvino & Leach, "Digital Principles and Applications", TMH.
2. M. Morris Mano, "Digital Logic Design", PHI
3. R.P. Jain, "Modern Digital Design", TMH.
4. S. Salivahanan & S. Arivazhagan, "Digital Circuits and Design", Vikas Publishing.
5. D. Roy Chaudhuri, Digital Circuits, "An Introduction Part -1 & 2", Eureka Publisher.
6. Ronald J Tocci , "Digital Systems, Principles and Applications", PHI.
7. Taub & Schilling, "Digital Integrated Electronics", TMH.

BEC–302: Semiconductor Materials and Analog circuits

Unit-1 Semiconductor Material Properties: Elemental & compound semiconductor materials , Bonding forces and energy bands in solids, Charge carrier in semiconductors , carrier concentration, Junction properties, Equilibrium condition, biased junction, Steady state condition, breakdown mechanism (Rectifying Diodes, Zener Diodes), Metal Semiconductor Junction.
Special diodes: Tunnel diodes, Varactor diodes, Schottky diode, Photo diodes, Photodetector, LED.

Unit-2 Diode circuits: Ideal and Practical diode, Clipper, Clamper.
Power Supply: Rectifiers-Half wave, Full wave, Bridge rectifier, filter circuits, Voltage regulation using shunt & series regulator circuits, Voltage regulation using IC.

Unit-3 Fundamentals of BJT: Operations, Biasing circuits, Ebersmoll model, The "r_e" model of transistor, Analysis of transistor Amplifier using h- parameters.

Unit-4 BJT Amplifiers: Single stage Amplifiers, BJT amplifier-Midband analysis of small signal amplifiers, Frequency response of Amplifier, Multistage Amplifier, Power Amplifier & Tunned Amplifier, Preliminary ideas on Bode plot, gain and phase margin.

Unit-5 FET Amplifiers: Analysis and design of different biasing circuits for FET amplifiers, small-signal model of FET, Low-frequency & High-Frequency analysis of CS, CG and CD amplifiers.

Text/Reference Books:

1. Millman & Halkias, "Electronic Devices And Circuits", TMH.
2. Salivahanan, Kumar & Vallavaraj, "Electronic Devices And Circuits", TMH.
3. Boylestad & Neshelsky, "Electronic Devices & Circuits", PHI.
4. Schilling & Belove, "Electronic Circuits , Discrete & Integrated", TMH.
5. Chattopadhyay & Rakhshit, "Electronic Fundamentals & Applications", New Age
6. Adel S. Sedra & Kenneth C. Smith, "Microelectronic Circuits", OUP.
7. R. A. Gayakwad, "Op-Amps And Linear Integrated Circuits", PHI
8. Theodore F. Bogart, Jeffrey S. Beasley, "Guillermo Rico Electronic Devices & Circuits".
9. Allen Mottershead, "Electronic Devices & Circuits".

BEC–303: Network Analysis and Synthesis

Unit-1 Graph Theory: Graph of a Network, definitions, tree, co-tree , link, basic loop and basic cut set, Incidence matrix, cut set matrix, Tie set matrix, Duality. Review of Laplace transform

Unit-2 Network Theorems (Applications to AC networks): Network elements, KVL, KCL, super node super mash, Super-position theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, compensation theorem, Tellegen's theorem, Source Transformations, Duality, State Variable Analysis .

Unit-3 Transient analysis: Inductance and capacitance, source free RL and RC circuits, application of the unit-step forcing function, RLC circuit-source free parallel and source free series.

Sinusoidal analysis: Sinusoidal forcing function, phasor concept, sinusoidal steady state response, complex frequency.

Unit-4 Two Port Parameter: Relationship of Two-port Variables, Short-circuit Admittance parameters, The open Circuit Impedance Parameters, Transmission parameters, The Hybrid parameters, relationships between parameters Sets, Parallel Connections of Two-port networks, reciprocity & symmetry, ladder & lattice network, T & π transformations.

Unit-5 Synthesis: Hurwitz polynomial, positive real function, Properties of positive real function, synthesis of LC, RL and RC driving point functions, synthesis of RC impedances of RL admittances.

Text/Reference Books:

1. William H. Hayt and Jack E. Kemmerly, "Engineering Circuit Analysis" , McGraw Hill International Edition, 1993.
2. Joseph Edminister and Mahmood Nahri, "Electric Circuits" , Third Edition, Tata McGraw Hill, New Delhi, 1999.
3. M.E. Vanvalkenburg- Network Analyses, (PHI)
4. D. Roy Choudhury, Networks and systems, New Age International Publication
5. Soni ML. & Gupta J.C., "A Course in Electrical Circuit Analysis" , Dhanpath Rai and Sons, New Delhi, 1981.
6. Umesh Sinha, "Network Analysis" , Satayaprakasan, New Delhi, 1986.
7. Paranjothi S.R., Electric Circuit Analysis, New Age International Ltd., New Delhi, 1996.
8. Chakrabati A., "Circuit Theory (Analysis and Synthesis)", Dhanpath Rai & Sons, New Delhi, 1999.
9. G.K.Mithal- Network analysis, Khanna publications

BEC-351: DIGITAL ELECTRONICS LAB

Note: Minimum of 8 experiments are to be performed from the following list:

1. Study of different basic digital logic gates and verification of their Truth Table.
2. Study and verification of the law of Boolean Algebra and De-Morgan's Theorem.
3. Study of important TTL technologies, Verifications of important TTL Circuit Parameters.
4. Construction and verification of various combinational circuits such as Half Adder, Full Adder, Half & Full Subtractor.
5. Study of Different Code Converters, Encoder, Decoder.
6. Study of Magnitude Comparator.
7. Study of Multiplexer, De-multiplexer.
8. Construction and verification of various types of Flip-Flops using gates and IC's.
9. Construction and Verification of different Shift Registers.
10. Construction and verification of different types of Counters.

BEC-352: ELECTRONICS LAB

Note: Minimum of 8 experiments are to be performed from the following list:

1. Diode Characteristic
   a) pn junction diode Characteristics and Static & Dynamic resistance measurement from graph.
   b) To plot Zener diode Characteristics curve.
2. Clipper Clamper
   a) To plot the Characteristics curve of various clamper circuits.
   b) To plot the Characteristics curve of various clamper circuits.
3. Half wave, full wave & bridge rectifier
   a) To measure Vrms, Vdc for half wave, full wave & bridge rectifier.
   b) To measure ripple factor, ratio of rectification for full wave & half wave rectifier.
4. Voltage regulation using zener diode shunt regulator and transistor series voltage regulator in the following cases
   a) Varying input
   b) Varying load
5. Characteristic of BJT
   a) To plot the input & output Characteristics curve in CB & CE configuration
   b) To find α & β and Q point from the above curve.
   c) To plot the Characteristics curve of various clipper circuits.
6. h- Parameter
   To measure h- parameter (Av, Ai, Ro & Ri) in CE Amplifier
7. Multi Stage Amplifier
   a) To plot the Characteristics curve for Direct Coupled Amplifier.
   b) To plot the Characteristics curve for RC Coupled Amplifier.
   c) To plot the Characteristics curve for transformer Coupled Amplifier.
8. FET Characteristic
   a) To plot the Characteristics curve for n channel – JFET in CS configuration.
   b) To find out pinch off voltage from the above characteristics curve
9. Op-Amp parameters measurements.
10. Power Amplifier
    a) Study of class A power Amplifier.
    b) Study of class B complementary symmetry Amplifier.

BEC-353: NETWORKS LAB

Note: Minimum of 8 experiments are to be performed from the following list:

1. Verification of KVL & KCL for the given circuit.
2. Verification of principle of superposition with dc and ac sources.
3. Verification of Thevenin, Norton and Maximum power transfer theorems in ac circuits.
4. Verification of Tellegen's theorem for two networks of the same topology.
5. Transient response in RL and RC Network: Simulation/hardware.
6. Transient response in RLC Series & Parallel circuits Network: Simulation/hardware.
7. Determination of Impedance (Z) and Admittance(Y) parameters of two port network.
8. Frequency response of LP and HP filters.
9. Frequency response of BP and BR filters.
10. Generation of Periodic, Exponential, Sinusoidal, Damped sinusoidal, Step, Impulse, Ramp signals using MATLAB in both discrete and analog form.
11. Determination of Laplace transform and inverse Laplace transformation using MATLAB.
12. Spectrum analysis of different signals.

BEC-401: ADVANCE ANALOG CIRCUITS

Unit-1Feedback Amplifiers: General theory of feedback, Barkhausen criteria, stability of feedback amplifier, different feedback topologies, effect of different parameters of an amplifier, feedback amplifiers, oscillation criteria and oscillator circuits. Variable frequency LC and RC sine wave oscillators, Crystal oscillators.

Unit-2 Waveshaping Circuits & Multi-vibrators: Astable, Bistable, Monostable Multivibrator, Blocking oscillator, Relaxation Oscillator, Schmitt Trigger, Linear time base circuits, PLL-architecture and applications, VCO architecture and applications, Synchronization and frequency division circuits.

Unit-3 Analog Circuits Overview: Current Mirror using BJT and MOSFET, Simple current mirror, cascade configuration, cascode configuration, Darlington connection.
Operational Amplifier: Introduction, ideal operational amplifier, Operational amplifier characteristics, equivalent circuit of Op-amp, open loop configuration, Op-amp applications, IC 741 Introduction.

Unit-4 Linear and Nonlinear Applications: Linear Applications- An Overview of Op-amp (ideal and non Ideal) based Circuits, V-I and I-V converters, Generalized Impedance Converter, simulation of inductors Filters, First and Second order LP, HP, BP, BS and All pass active filters, KHN, Tow-Thomas and State Variable Biquad filters, Sinusoidal oscillators.
Nonlinear Applications- Log & Anti-Log Amplifiers, Precision Rectifiers, Peak Detectors, Sample and Hold Circuits, Analog Multipliers and their applications. Op-amp as a comparator, Zero crossing detector, Schmitt Trigger, Astable multivibrator, Monostable multivibrator, Generation of Triangular Waveforms.

Unit-5 D/A and A/D converters: Basic DAC Techniques DAC Characteristics, D to A conversion process types of DAC (Weighted Resistor DAC, R-2R Ladder)
ADC and Types: Parallel Comparator ADC, Counter type ADC, Successive Approximation ADC, Integrating types of ADC, ADC using V to F converters, Dual slope ADC, Charge redistribution Converter, ADC Characteristics.
Integrated Circuit Timer: The 555 Circuit, implementing a Monostable Multivibrator using the 555 IC, Astable Multivibrator using the 555 IC.
Phase locked loops (PLL): Ex-OR Gates and multipliers as phase detectors, Block Diagram of IC PLL, Working of PLL and Applications of PLL.

Text/Reference Books:

1. Millman & Hailkias, “Electronic Devices And Circuits”, TMH.
2. Salivahanan, Kumar &Vallavaraj, “Electronic Devices And Circuits”, TMH
3. Boylestad & Neshelsky, “Electronic Devices & Circuits”, PHI
4. R. A. Gayakwad, “Op-Amps And Linear Integrated Circuits”, PHI
5. R.P. Jain, “Modern Digital Design”, TMH.
6. D. Roy Chaudhary, Shail Jain, “Linear integrated circuits”, New Age International.

BEC-402: ELECTRONICS MEASUREMENTS AND INSTRUMENTS

Unit-1 Theory of Measurement: Introduction, Characteristics of Instruments and measurement systems (Static &Dynamic) Error analysis: Sources, types and statistical analysis. Instrument Calibration: Comparison Method.

Unit-2 Transducers
Passive transducers : Resistive, Inductive and capacitive
Active transducers : Thermoelectric, piezoelectric & photoelectric
Bridges : Direct current and alternating current bridges, LCR bridges, Q meter.

Unit-3 Analog Meters: Operating Forces. Constructional Details, Types of supports, Balancing Torque/Weight ratio. Control Systems, Damping Systems. Galvanometers. Analog Ammeters Voltmeter and Ohmmeter (PMMC, PMMI). Electrodynamometer Instruments. Electronic analog ohmmeter and multimeter, Powerfactor meter, Frequency meter.

Unit-4 Digital Meters: Analog to digital converter- Transfer characteristics, A/D Conversion techniques: Simple potentiometric & servo method, successive approximation, ramp type, Integrating & dual-slope integrating method. D/A Converter - Transfer characteristics, D/A conversion techniques Digital mode of operation, performance characteristics of D/A converters. Specification of digital meters: display digit & counts resolution, sensitivity , accuracy, speed & settling time etc.

Unit-5 Oscilloscopes & RF Measurements-Types of oscilloscopes, controls, Measurement of voltage, frequency time & phase. High frequency measurements – RF impedance.

Signal Generators: Sine-wave, non- sinusoidal & function generators, frequency synthesis techniques & digital signal generators. Signal Analyzers : Distortion, wave and Network spectrum analyzers

Text/Reference Books:

1. Albert D. Helfrick, William David Cooper, “Modern electronic instrumentation and measurement techniques”, TMH 2008.
2. Oliver Cage, “Electronic Measurements and Instrumentation”, TMH, 2009.
3. Alan S. Morris, “Measurement and Instrumentation Principles”, Elsevier (Buterworth Heinmann), 2008.
4. David A. Bell, “Electronic Instrumentation and Measurements”, 2nd Ed., PHI, New Delhi 2008.
5. H.S. Kalsi, “Electronics Instrumentation”, TMH Ed. 2004
6. A.K.Sawhney, “A Course in Electrical and Electronic Measurements and Instrumentation”, Dhanpat Rai.
7. MMS Anand, “Electronic Instruments & Instrumentation Technology”, PHI Pvt. Ltd., New Delhi Ed. 2005

BEC – 403: ELECTROMAGNETIC THEORY

Unit-1 Fundamentals of Vector Algebra: Coordinate systems, Cartesian, cylindrical and spherical co-ordinate systems, scalar and vector fields, gradient, divergence and curl of a vector fields, Divergence theorem and Stokestheorem.

Unit-2 Electrostatics: Electrostatic fields, Coulombs law and field intensity, Electric field due to charge distribution, Electric flux density, Gausses's Law – Maxwell's equation, Electric dipole and flux lines, energy density in electrostatic fields, Electric field in material space: Properties of materials, convection and conduction currents, conductors, polarization in dielectrics, dielectric constants, continuity equation and relaxation time, boundary condition. Electrostatic boundary value problems: Poisson's and Laplace's equations, resistance and capacitance, method of images.

Unit-3 Magnetostatics: Magneto-static fields, Biot-Savart's Law, Ampere's circuit law, Maxwell's equation, application of ampere's law, magnetic flux density- Maxwell's equation, Maxwell's equation for static fields, magnetic scalar and vector potential. Magnetic forces, materials and devices: Forces due to magnetic field, magnetic torque and moment, a magnetic dipole, magnetization in materials, magnetic boundary conditions, inductors and inductances, magnetic energy.

Unit-4 Equation Of Continuity For Steady & Time Varying Currents, Maxwell's Law, Displacement Current & Displacement Current Density, Wave Equation, Pharos Concept for Time Harmonic Fields, Plane Waves in Simple Media & Lossy Media, Inhomogeneity & Anisotropy. Polarization, Poynting Theorem, General Complex, Power & Power Density.

Unit-5 Transmission lines: Transmission line parameters, Transmission line equations, input impedance, standing wave ratio and power, The Smith chart, some applications of transmission lines.

Text/Reference Books:

1. William Hayt, "Engineering Electromagnetic", McGraw Hill.
2. Matthew N.O. Sadiku, "Elements of Electromagnetics", Oxford Univ. Press.
3. Jordan and Balmain, "Electromagnetic Wave and Radiation System" PHI.
4. Kraus, "Electromagnetics", TMH.
5. Cheng, "Field & Waves", Pearson Education (LPE).
6. Edminister, "Electromagnetics", Schaum series.
7. Parmanik, "Electromagnetism", PHI.

BEC-404: SIGNALS AND SYSTEMS

Unit-1 Introduction of Signals and Systems: Definition of signal, Classification of Signal and representation: Continuous time and discrete time, even/odd, periodic/aperiodic, random/deterministic, energy/power, one/multidimensional, some standard signals, , Basic Operations on Signals for CT/DT signal, transformation of independent & dependent variables,

Definition of system and their classification: CT/DT, linear/non-linear, variant/non-variant, causal and non-causal system state/dynamic system, interconnection of systems.

Unit-2 Linear Time- Invariant Systems: Introduction, Convolution, Impulse Response Representation for LTI Systems, Properties of the Impulse Response Representation for LTI Systems, Differential and Difference Equation Representations for LTI Systems, Block Diagram Representations.

Unit-3 Fourier Representations for Signals: Introduction and Properties, Parsevals theorem inverse FT, relation between LT & FT, Applications of Fourier Representations, Introduction Frequency Response of LTI Systems, Fourier Transform Representations for Periodic Signals, Convolution.

Unit-4 Fourier Transform Representation for Discrete-Time Signals, Sampling, Reconstruction of Continuous-Time Signals from Samples, Fourier Series Representations for Finite-duration Non-periodic Signals. Filtering and Signal Distortion: Time Response, Frequency Response, Linear Distortion and Equalization, Ideal Low-Pass Filters, Band-Pass Transmission, Phase Delay and Group Delay, Nonlinear Distortion.

Unit-5 Spectral Density and Correlation, Energy: Spectral Density, Correlation of Energy Signals, Power Spectral Density, Correlation of Power Signal, Spectral Characteristics of Periodic Signals, Spectral Characteristics of Random Signals and Noise, Noise Equivalent Bandwidth, random & stochastic process.

Reference Books:

1. Simon Haykin, “Signals and Systems”, John Wiley.
2. Simon Haykin, “Analog and Digital Communications”, John Willey.
3. Bruce Carlson, “Signals and Systems”, TMH.
4. Oppenheim & Wilsky, “Signals & Systems”, PHI.
5. Taub and Schilling "Principles of communication signals", 2nd ed. New York: Mcgraw-Hill, 1986.

BEC–451: ADVANCE ANALOG CIRCUITS LAB

Note: Minimum of 8 experiments are to be performed from the following list:

1. Transistorized oscillators- Phase shift, Wein bridge, Hartley's & Collpit's.
2. IC 555 Timer-Monostable & Astable operation circuit.
3. IC 565- PLL Applications.
4. IC 566- VCO Applications.
5. Study of A/D, D/A Converters.
6. To study of Op-amp as summar, integrator & voltage comparator.
7. Study of Op-amp as astable & monostable multivibrators.
8. Sampling & reconstruction using Nyquist criteria.
9. Function generator using operational amplifier (single, triangular & sq. wave)
10. FET Amplifiers.
    (a) Single Stage Common source FET amplifier plot of gain (in db) vs frequency.
    (b) Measurement of BW, input impedance, maximum signal handling capacity of as
    (c) amplifier.
11. A/D & D/A converter.
12. Voltage to current & current to voltage converter.
13. Filter design using Op-amp.

BEC–452: ELECTRONICS MEASUREMENTS & INSTRUMENTS LAB

Note: Minimum of 8 experiments are to be performed from the following list:

1. Calibration of AC Voltmeter and Ac Ammeter.
2. Study of the following transducers :
   (a) PT-100 transducers
   (b) J-type
   (c) K – type.
3. Characteristics of LVDT.
4. Characteristic of Diaphragm type pressure transducer.
5. Measurement of unknown resistance by Wheatstone bridge and bridge sensitivity.
6. Measurement of low resistance using Kelvin's double bridge.
7. Measurement of capacitance by De' Sautys and Schering bridge.
8. Measurement of Inductance by Anderson's and Hay's Bridge.
9. Study of L.C.R. bridge and determination of the value of the given components.
10. Study of semiconductor diode voltmeter and its uses as DC average responding AC volt meter.
11. Measurement of Power & Power factor.
12. A/D & D/A converters.
13. Measurement of phase difference and frequency using CRO (Lissajous Pattern).

BEC–453: ELECTRONICS WORKSHOP & PCB LAB

1. Winding shop: Step down transformer winding of less than 5VA.
2. Soldering shop: Fabrication of DC regulated power supply
3. PCB Lab: (a) Artwork & printing of a simple PCB.
   (b) Etching & drilling of PCB.
4. Wiring & fitting shop: Fitting of power supply along with a meter in cabinet.
5. Testing of regulated power supply fabricated.
6. Fabricate and test the audio amplifier circuit by using above power supply.