

Curriculum Framework

Diploma in Hearing Aid and Ear Mold Technology-DHAEMT

Norms, Regulations & Programme Content

November, 2015

**Effective from Academic Session 2016-17
One Year Duration**



भारतीय पुनर्वास परिषद

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Diploma in Hearing Aid and Ear Mold Technology

1. Purpose of the course

There are more than one million hearing aid users in the country and a 7% growth in hearing aid industry is predicted in the coming years. Poor after sales service has meant that a large number of hearing aids are either unutilized or underutilized by our clients. This is especially true with children in special schools, rural population and women with hearing impairment. There is a felt need for a class of semi-professionals or skilled persons who can address the basic maintenance - service issues relating to hearing aids and assistive listening devices felt by the different groups of hearing aid users referred to above. Therefore, a diploma program of this nature is warranted. Additionally, persons so trained under the diploma program can fill critical practical voids in the hearing aid industry.

2. Aim

Aim of the program is to train a class of persons and equip them with skills for care, maintenance and repair of hearing aids, assistive devices and address the needs of our clientele relating to ear s.

3. Objectives

The objectives of the diploma course are to increase the availability of manpower

- a) equipped with skills for maintenance and services of hearing aids as well as other listening devices services,
- b) with skills to make all kinds of ears for the hearing impaired,
- c) with skills to address the service needs of persons with hearing impairment in different set ups, and
- d) train manpower who will address all service-related issues of the hearing impaired relating to hearing aids, assistive listening devices and ear s and ensure that these devices are optimally utilized.

4. Duration of the course

The duration of the course will be one year, which can be completed in a maximum of two years from the date of admission to the programme.

5. Eligibility for admission

- a) A pass in 12th class with Physics or Electronics as one of the papers, or any recognized diploma in Electronics/ Electrical engineering, or any qualified dental technician course, or Certificate or Diploma from ITI in Electronics/Electrical Engineering area.
- b) Candidates who are <24 years on the 1st July of the year of admission

6. Criteria for passing

40% each in theory and practical examination.

7. Attendance

Minimum 80% attendance in theory and 90% in practical classes is required. Students may avail 20 days leave in a year.

8. Examination

There shall be one examination at the end of the course. The examination shall be in English. In view of the technical nature of the course and the field, the medium of instruction shall be English

9. Certificate

Certificates shall be issued by the examining body nominated by the RCI.

10. Theory and practical hours

Calculated on the basis of 7 hours / day, 5 days / week and 38 weeks / year
= 1330 hours per year

Theory Papers

Hearing Aids: 3 hrs / week for 30 weeks - 90hrs
Ear Molds : 3 hrs / week for 30 weeks - 90 hrs

Practicals

A minimum of 550 hours for each of the 2 practicals

Library / others

50 hours

11. Examination Pattern

Paper	Title of the paper	No. of hours / week	Marks		
			Final* Exam	IA	Total
DHAEMT 1	Hearing aids	3	80	20	100
DHAEMT 2	Ear Molds	3	80	20	100
DHAEMT 3 Practicals	Hearing aids		75 [!]	75 [@]	150
DHAEMT 4 Practicals	Ear Molds		75 [!]	75 [@]	150

* Duration of each examination - theory as well as practicals - shall be 3 hours

! Marks to be awarded by the external examiner

- @ Final practical exam shall be conducted by both internal and external examiners. Maximum marks shown here under IA are not internal assessment marks, but annual examination marks to be decided by the internal examiner.

12. Question paper pattern

The following is only an illustration. Important thing to note is that there has to be internal choice for each question.

Unit No.	Question	Sub-question	Marks
I	1 or 2	a.	8
		b.	8
II	3 or 4	a.	7
		b.	5
		c.	4
III	5 or 6	a	10
		b	6
IV	7 or 8	a	8
		b	8
V	9 or 10	a	6
		b	4
		c	6

12. Declaration of results and award of Diploma

There will be a uniform pattern of declaration of results as under:

75% and above	-	Distinction
60-74.9%	-	First Division
50-59.9%	-	Second Division
40-49.9%	-	Pass Class

Diploma / certificate will be awarded to the successful candidates by the examining body nominated for this purpose by the Rehabilitation Council of India.

13. Guidelines for special assistance to examinees with disabilities

Based on the medical certificate issued by the competent authority, and as provided for CBSE /State Governments / UGC and NIOS for students with disabilities, special provisions are to be given in terms of providing scribes, computers, extra time, separate room and readers to student-trainees.

Course Content

DHAEMT 1- Hearing Aids & Assistive Listening Devices

Objectives

After training in this subject, the student should be able to

- a) identify and describe function(s) of each component used in hearing aids.
- b) undertake repair of body worn and BTE hearing aids, assistive listening devices etc.
- c) carry out electro-acoustic evaluation of hearing aids and interpret the analysis report.
- d) organize and manage a hearing aid repair lab
- e) maintain and repair assistive listening devices, and
- f) advise hearing aid users on the maintenance and care of hearing aids and other hearing devices.

Unit 1 **Electronic Components**

15 hrs

Passive components

- Resistors: Definition of resistance, Ohm's law, color coding, power rating, types of resistors, series and parallel combination, variable resistors such as trim-pots, multi-turn pots, volume controls etc.
- Capacitors: Definition of capacitance, working of a parallel plate capacitor, color coding, voltage rating, types of capacitors, series and parallel combination, variable capacitors.
- Inductors: Definition of inductance, working of an inductor, types of inductors, variable inductances, inductor rating.
- Transformers: Principle of electromagnetism – mutual inductance – transformer theory, types of transformers such as voltage transformer, current transformer, power transformer, output transformer, pulse transformer etc.

Active components

- Diodes: Forward and reverse biased pn junctions, different types of diodes such as rectifier diode, signal diode, zener diode, light emitting diode, diode rating and specifications.
- Transistors: Basic structure and working of NPN and PNP transistors. How does a transistor work as an amplifier, CE, CB & CC configurations, types of transistors, specifications and rating of transistors, structure and working of JFET's & MOSFETs.

Unit 2 **Basic Electronic circuits and digital electronics**

15 hrs

- Transistor amplifiers: Single stage and multistage amplifiers, voltage amplifiers and power amplifiers, R-C coupled, direct coupled and transformer coupled amplifiers, class

A, B, AB, C & D operation of amplifiers, AF, wideband and RF amplifiers, positive and negative feedback.

- Operational amplifiers: Concept of differential amplification, concept of an OPAMP and its ideal characteristics, inverting, non-inverting, summing and integrating amplifier circuits using OPAMPs.
- Oscillator: Theory of oscillations – sine-wave, oscillators – Wein bridge oscillator, TC phase shift oscillators, Hartley, Colpits, Crystal oscillators, etc.
- Filters: Classification of filters based on frequency response, active and passive filters, basic concept of a digital filter.
- Modulation and demodulation: Necessity for modulation, different types of modulation – amplitude modulation, frequency modulation and demodulation.
- Linear integrated circuits: IC 741, IC 552, IC LE507 –pin out and applications.
- Binary number system: Decimal to binary and binary to decimal conversion. Logic gates, operation of NOT, AND, OR, NAND, NOR, EX-OR & EX-NOR gates and their truth table.
- Analog to digital and digital to analog converters: Structure and function of different types.
- Brief introduction to computers & peripherals: Block diagram, components and specifications.

Unit 3 Hearing Aid Components & Amplification

20 hrs

- Introduction to hearing aids: General block diagram, familiarization with different components used in the hearing aids, types of hearing aids – body level, behind the ear, in the ear, in the canal, CIC, RIC etc., mild, moderate, strong and extra-strong categories.
- Microphone: Structure and working of condenser and electret condenser microphones, directional microphones, requirements of a hearing aid microphone.
- Receiver: Structure and working of different types of receivers, requirements for a hearing aid receiver.
- Amplifier: 3 stages of amplification – Preamplifier, second stage amplifier, output amplifier, requirements of hearing aid amplifier.
- Hearing aid controls and cords: Volume control, OTM switch, Tone Control, Peak Clipping (PC), Maximum Power Output (MPO), 2 pin/ 3 pin S-cord, Y-cord.
- Battery: Different types of cells used in hearing aids and their features, requirements for a hearing aid battery.

- Linear amplification: Threshold and uncomfortable levels of hearing, dynamic range, soft sounds, loud sounds etc., problems with linear amplification in hearing aids.
- Non-linear amplification: Need for non-linear amplification, compression – Need and types of compression, compression ratio, compression threshold, AGC – Need and types – input AGC & output AGC, attack time, release time etc.
- Amplifier circuits for hearing aids: Transistorized circuits, IC based circuits & circuits with AGC.

Unit 4 Digital Hearing Aids & Electroacoustic Evaluation

20 hrs

- Introduction to digital hearing aids: Block diagram and working of each stage, need for digital technology, advantages and limitations.
- Basics of digital signal processing: Functions of a digital signal processor in hearing aids.
- Channel separation: Number of channels, bandwidth, controlling the gain of each channel and bands.
- Programming a digital hearing aid: Block diagram of the setup, organizing a programming set up etc.
- Programmable hearing aids: Block diagram and working of each stage, need for programmable technology, advantages and limitations.
- Electro acoustic measurements: Hearing aid analyzer, parameters of evaluation, hearing aid standards.
- Speech perception through hearing aids: Quality of output sound, factors affecting quality, intelligibility of sound, factors influencing intelligibility.
- Preventive maintenance and care: How to take care of hearing aids and their components.
- Troubleshooting: Probable troubles and their remedies – BTE & body level hearing aids.

Unit 5 Group Hearing Aid Systems & Assistive Listening Devices

20 hrs

- Introduction: Difference between personal and group hearing aids, need, advantages of group hearing aids over personal hearing aids, types of group hearing aid systems.
- Block diagram, principle of operation, implementation, applications, advantages and limitations of the following systems:-
 - Induction loop system
 - Hardwire system
 - Infrared system

- FM system
- ALDS: Discussion of different types of assistive listening devices & trouble shooting.

Books for Reading

1. Mehta, V.K. (1994). Principles of Electronics. S Chand & Co., New Delhi.
2. Sandlin, R. E. (1995). Hand book of hearing aid amplification. Singular Publications, San Diego.
3. Vonlanthen, M. (2000). Hearing instrument technology. San Diego, San Diego.
4. Hersh M. A. & Johnson M.A. (2003). Assistive technology for the hearing impaired deaf and deaf blind. Springer, London.
5. Floyd, T.L. (1986). Digital fundamentals. Universal Book Stall, New Delhi.

DHAEMT 2 - Ear Mold Technology

The objectives of this course is to train students

1. to make ear molds of different types and in different set-ups, and
2. to organize and manage an ear mold lab

Unit 1 Anatomy and acoustics of conductive pathway 15 hours

- Anatomy of the external ear and its variation
- Acoustics of external ear and its importance
- Brief anatomy of middle and inner ear

Unit 2 Hearing loss 15 hours

- Nature and types of hearing loss
- Causes of conductive, mixed and sensorineural hearing loss
- Candidacy for hearing aids

Unit 3 Ear molds: Types and impression 20 hours

- Ear mold and its role in hearing
- Types of ear molds
- Parts of ear molds
- Materials used in ear mold impression and ear mold, its properties, bio-interaction with skin allergies and precautions while selecting materials
- Procedure for taking ear Mold impression and precautions

Unit 4 Making of ear molds 20 hours

- Stages in making hard mold
 - Methods of hard mold making
 - ✓ UV curing
 - ✓ Acrylic
- Stages in making soft mold
- Acoustic modifications of ear mold and its consequences

Unit 5 Organization skills and ear mold for special purposes 20 hours

- Setting up of ear mold lab
- Impression taking and shell making of custom hearing aids
- Community based ear mold impression taking and ear mold making
- Making of ear plugs and swimmers plugs
- Care, maintenance and counselling about ear molds

Books for Reading

1. Katz, J. (1978). Handbook of clinical audiology, 2 ed. Chapter on Ear moulds , Vol I, Williams and Wilkins, Baltimore.

2. Johnson, G. H. (2002). Impression materials. In R.G. Craig and J. M. Powers (Ed.). Restorative dental materials 11th India Private Limited.
3. Loavenbruk, A. M., & Madell, A. I. (1981). Hearing aid dispensing for audiologist. A guide for clinical service. New York: Grune and Stratton.
4. Leavitt, R. (1981): Ear moulds: Acoustic and structural consideration. In Hodgson W. R. And Skinner P. H (Eds). Hearing aid assessment and use in audiological habilitation
5. Pollack, M. C., & Morgan, R. (1980). Ear mould technology and acoustics. Pollack M. C. (Ed). Amplification for the hearing impaired. 2nd Grune and Stratton, 111 – 113.
6. Tucker, I., & Nolan, M. (1984). 'The Ear mould' in Educational Audiology, Great London, Croom Helm Ltd., 172 – 199). Baltimore, Williams and Wilkins,

Skills to be achieved and assessed for internal assessment and practical examination

DHAEMT 3 Practicals1: Hearing Aids:

Practical skills relating to

1. Identification of the problem
2. Cause finding
3. Rectifying the problem
4. Verification
5. Client satisfaction
6. Counseling the client

DHAEMT 4 Practicals2:Ear Mold technology:

Practical skills relating to

1. Inspection and documentation of the status of external ear canal
2. Selection of material for impression taking and ear mold making
3. Ear mold fitting skills
4. Trouble shooting of ear molds, and
5. Practical records of the following type:
 - a) The students are required to maintain records of 50 ear impressions and 10 finished s of each type at the end of the year.
 - b) Student should maintain records of at least 25 impressions of custom hearing aids

Diploma in Hearing Aid and Ear Mold Technology

The following are the specific requirements for starting a Diploma in Hearing Aid and Ear Mold Technology with an intake of 20 students in addition to the general requirements documented by RCI.

Infrastructure

The following infrastructure is a must for a batch of 20 students.

1.0 Staff

1.1 Core faculty

- | | | |
|----|---------------------|---|
| a) | Ear Mold technician | 1 |
| b) | ITI instructor | 1 |

1.2 Supporting Faculty / Staff

- | | | |
|----|--|---|
| a) | Lecturer in Audiology
(with M.Sc-Aud. Or M.Sc (Sp. & Hg).or MASLP) | 1 |
| b) | Lecturer in Electronics
(with B.E- Electronics or M.Sc - Electronics) | 1 |

1.3 Supporting Staff

- | | | |
|----|-------------------------|---|
| a) | Aministrative Assistant | 1 |
| b) | Library Assistant | 1 |
| c) | Attenders | 2 |

2.0 Equipment

- Hydraulic Press
- Polishing Unit
- Thermal / Hot Oven
- Micro Motor
- UV light pistol
- UV Cure Unit
- Duplicating Device
- Wax immersion kit
- Ultra sonic cleaner
- Plaster dispenser
- Work bench with Suction Unit
- Dental Lathe
- Vacuum mixer
- Vibrator
- Pressure pot
- Air compressor
- Hearing aid analyzer.

- Illuminating magnifying lens 3 x for BTE aids
- Multi meter digital

2.1 Tools

Street noseplayer 5"	Basic Material for UV Cure Mold Making
Steel outtr 4"	Silicon Impression Material
Screwdrivers 3",4",5"	Impression Syringe
Brush	Bayonet Tweezers
Forceps	Impression Wax Green
Knife	Dipping Sieve
Round file Jewellers	Investment form Transparent
Flat file Jewellers	Duplicating Gel Agar
Cuttingplier 6"	LP cleaner
Benchvice	LP/H Transparent (Hard UV Polymer)
Small Hacksaw	Flex AB 40 (Soft UV Polymer)
Hand drill with bits 0.8 mm to 2mm	Pump Dispenser for UV polymer
Watch mechanic screwdriver set	UV Safety Goggles
Soldering Iron (Soldron or Tony make) 25 watts with different tips	Glue for tubing
Soldering Iron stand	Glue Primer
Soldering paste	Metal snap ring
Soldering lead 100 gins 60-40	Place maker for snap ring
Battery compartment or battery bolder	Snap ring for soft ear mould
Signal injector	Connecting Spring for soft ear mould
Cellotape	Lacquer for UV Hard
Bonifix	Lacquer for UV Soft
Flexible wire 7 stand	Transparent container for Cleaning liquid
Disposable syringe	Pre Bend PVC soft tube
Stethoscope without diaphragm	Ear light
Spare hearing aid cords 2 pin single cord, 2 pin v cord, 3 pin single cord	
Cord tester and cell tester or multimeter	Basic Materials for Soft Mold Making
Desoldering pump	Silicon Impression Material
Bee wax	Impression Syringe
Table lamp and 2 tube lights.	Flask and clamp
	Rubber Bowl
Basic Materials for Hard Mold & Hard Shell Making	Plaster Spatula
	Plaster of Paris
Flask & Clamp	Stone plaster
Glass Bowl	Bayonet Tweezers

Cotton Buff	Scooping Instrument (Probe)
Soldering Gun	Could Mould Seal
Silicon Impression Material/Alginate	Silicon Packing Material
Impression Syringe	Silicon Injector
Rubber bowl	Mixing Canula
Spatula	Canula tip
Plastic sheet	Lacquer
Impression Lids	Pre Bend PVC soft tube (1.5x2.5mm)
Plaster of Paris	Pre Bend PVC soft tube (2.0x3.1mm)
Stone Plaster	Ear light
Could Mould Seal 3.5 lt	
Heat Cure Polymer 3kgs	
Heat Cure Monomer 4lt	
Self Cure Monomer & Polymer	
Pumice 1kg	
Snap rings	
L- Connector	
PVC Soft Tube 1 roll	
Ear light	

3.0 Space

- | | |
|---------------------------------|-------|
| a) 10x15' Classroom | 1 No. |
| b) 10x15' Ear lab | 1 No. |
| c) 10x 15' Hearing aid workshop | 1 No. |
| d) 10x10' Office room | 1 No. |
| e) 10' x 15' Library | 1 No. |

4.0 Furniture

- Furniture for storing finished products
- Chairs and work benches (4 each)
- Wooden table measurng 2' x 4' with 2' height (4)
- Chairs (4) and steel almirahs(2)
- 5 amps multisocket with switch (2)

5.0 Library

The following books are minimum

- Floyd, T.L. (1986). Digital fundamentals. Universal Book Stall, New Delhi.
- Hersh M. A. & Johnson M.A. (2003). Assisive technology for the hearing impaired deaf and deaf blind. Springer, London.
- Johnson, G. H. (2002). Impression materials. In R.G. Craig and J. M. Powers (Ed.). Restorative dental materials 11th India Private Limited.
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