

**For Batch 2016-17 Onwards
SCHEME OF EXAMINATION**

for

BACHELOR OF VOCATION

In

(REFRIGERATION AND AIR CONDITIONING)

5rd SEMESTER to 6th SEMESTER

Offered by

University School of Information, Communication & Technology



**Guru Gobind Singh Indraprastha University
Dwarka, Delhi – 110078 [INDIA]**

www.ipu.ac.in

NOMENCLATURE OF CODES GIVEN IN THE SCHEME OF B.VOC

1. **ET** stands for Engineering and Technology.
2. **V** stands for Vocation.
3. **MC** stands for Mobile Communication.
4. **SD** stands for Software Development.
5. **AE** stands for Automobile.
6. **CE** stands for Consumer Electronics.
7. **PT** stands for Printing Technology.
8. **CT** stands for Construction Technology.
9. **RA** stands for Refrigeration & Air-Conditioning.
10. **PD** stands for Power Distribution Management.
11. **ID** stands for Interior Design.
12. **AA** stands for Applied Arts.
13. **CS** stands for Computer Science.
14. **MS** stands for Management Studies.
15. **EN** stands for Environmental Engineering
16. **PH** stands for Physics
17. **AS** stands for Applied Science.
18. **HS** stands for Humanities and Social Sciences.
19. **SS** stands for Social Services.
20. **L/T** stands for Lecture and Tutorial
21. **P** stands for Practicals.
22. **S/D** stands for Drawing/Studio
23. **P/D** stands for Practical/Drawing



**BACHELOR OF VOCATION
(REFRIGERATION AND AIR CONDITIONING)
FIFTH SEMESTER EXAMINATION
(LEVEL-VII)**

Paper Code	Paper ID	Paper	L	T/P	Credits
THEORY PAPERS					
ETVHS-701		Technical English (Common to all disciplines)	3	0	3
ETVRA-701		Advanced Psychrometry and Heat Load Calculation	3	1	4
CORE ELECTIVE-II (Select any one)					
ETVRA-703		Cryogenic Engineering	3	1	4
ETVRA-705		Vapour Absorption and Non-Conventional Refrigeration System	3	1	4
CORE ELECTIVE-III (Select any one)					
ETVRA-707		Measurement and Instrumentation	3	1	4
ETVRA-709		Pipe Design and Pump Selection	3	1	4
GENERAL ELECTIVE-II (Select any one)*					
ETVSS-751		NCC	0	2	1
ETVSS-753		NSS	0	2	1
ETVSS-755		Sports	0	2	1
ETVSS-757		Community Services	0	2	1
ETVSS-759		ECO Club	0	2	1
ETVSS-761		YOGA	0	2	1
PRACTICAL/VIVA VOCE (Select any one Lab based on CORE ELECTIVE-II)					
ETVRA-753		Cryogenic Engineering Lab	0	3	3
ETVRA-755		Vapour Absorption and Non-Conventional Refrigeration System Lab	0	3	3
PRACTICAL/VIVA VOCE (Select any one Lab based on CORE ELECTIVE-III)					
ETVRA-757		Measurement and Instrumentation Lab	0	3	3
ETVRA-759		Pipe Design and Pump Selection Lab	0	3	3
PRACTICAL/VIVA VOCE					
ETVHS-751		Language Lab (Common to all disciplines)	0	3	3
ETVRA-751		Advanced Psychrometry and Heat Load Calculation Lab	0	3	3
ETVRA-761		Minor Project	0	8	4
ETVRA-763		Industrial Training-IV	0	2	4
TOTAL			12	27	36

NOTE:

There are five industrial trainings to be carried out by the student(s) in B.Voc course. Industrial Trainings I, III and V will be with weightage of two credits each. These trainings are to be carried out during winter vacations for the duration of two weeks. Industrial Trainings II and IV will be with weightage of four credits each. These trainings are to be carried out during summer vacations for the duration of four to six weeks. These training may be done from industry/Skill Knowledge Providers (SKPs) /Sector Skill Councils (SSCs) / Training Centers/Institutes. Student should submit training report during evaluation. Industrial Training done at the end of the semester will be evaluated in the subsequent semesters.

*(Non University Examination Scheme)

**BACHELOR OF VOCATION
(REFRIGERATION AND AIR CONDITIONING)
SIXTH SEMESTER EXAMINATION
(LEVEL-VII)**

Paper Code	Paper ID	Paper	L	T/P	Credits
THEORY PAPERS					
ETVRA-702		Duct Design and Air Distribution	3	0	3
CORE ELECTIVE-IV (Select Any One)					
ETVRA-704		Commercial System	3	0	3
ETVRA-706		Energy Conservation and Audit	3	0	3
CORE ELECTIVE-V (Select Any One)					
ETVRA-708		Automobile Air-Conditioning	3	0	3
ETVRA-710		Non-Conventional Energy Resources	3	0	3
PRACTICAL/VIVA VOCE					
ETVRA-752		Duct Design and Air Distribution Lab	0	3	3
ETVRA-754		MATLAB	0	3	3
ETVRA-756		Industrial Training-V	0	2	4
ETVRA-758		Major Project#*	0	24	12
TOTAL			09	31	31

NOTE:

There are five industrial trainings to be carried out by the student(s) in B.Voc course. Industrial Trainings I, III and V will be with weightage of two credits each. These trainings are to be carried out during winter vacations for the duration of two weeks. Industrial Trainings II and IV will be with weightage of four credits each. These trainings are to be carried out during summer vacations for the duration of four to six weeks. These training may be done from industry/Skill Knowledge Providers (SKPs) /Sector Skill Councils (SSCs)/ Training Centers/Institutes. Student should submit training report during evaluation. Industrial Training done at the end of the semester will be evaluated in the subsequent semesters.

#*The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format, thereafter he/she will have to present the progress of the work through seminars and progress reports. Seminar related to major project should be delivered one month after starting of Semester. The progress will be monitored through seminars and progress reports. *The students may be allowed to do Industrial Major Project on-site during 5 days in a week and class work should be completed in 2 working days in the respective institution.*

For Award of Diploma:

1. The total number of the credits of the Diploma (RAC) Programme = 62.
2. Student shall be required to appear in examinations of all courses. However, to award the Diploma (RAC) a student shall be required to earn a minimum of 60 credits.

For Award of Advanced Diploma:

1. The total number of the credits of the Advanced Diploma (RAC) Programme = 125.
2. Student shall be required to appear in examinations of all courses. However, to award the Advanced Diploma (RAC) a student shall be required to earn a minimum of 120 credits.

For Award of B.Voc Degree:

1. The total number of the credits of the B.Voc. (RAC) Programme =192.
2. Student shall be required to appear in examinations of all courses. However, to award the Degree B.Voc. (RAC) a student shall be required to earn a minimum of 180 credits.

TECHNICAL ENGLISH
(Common to all Disciplines)

Paper Code: ETVHS-701
Paper: Technical English

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTER:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objectives:

- To equip students to recognize, explain, and use the rhetorical strategies and the formal elements of specific genres of technical communication, such as technical abstracts, data based research reports, instructional manuals, technical descriptions etc.
- To help students understand the process of collection, analysis, documentation, and reporting of research clearly, concisely, logically, and ethically and understand the standards for legitimate interpretations of research data within scientific and technical communities.
- To initiate students into critical and creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information towards meaningful and effective communication
- To help students understand ethical considerations in technical and professional writing, realizing the consequences of various communication acts.

Learning Outcomes: Upon successful completion of the course the student shall be able to:

- Understand and demonstrate composing processes through invention, organization, drafting, revision, editing, and presentation as evidenced in satisfactory completion of all the written, visual, web-based, and oral discourses to be submitted in this course.
- To recognize and use the rhetorical and stylistic elements necessary for the successful practice of scientific and technical communication;
- Create various products most frequently used in scientific and technical communication.
- Develop ethical problem-solving communication skills in professional situations.

UNIT-I

Technical Writing: Definition, Purpose and Characteristics of Technical Writing.

Technical Writing Skills: Methods and means of the Pre-writing stage, the Writing Stage and the Post-writing Stage.

[T1, T2][No. of Hrs. 12]

UNIT-II

Formal Formatting: Arrangement of Formal Elements, Front Material, Format Devices in the Body of Formal Report-Heading, Pagination, End Material – Citations, References and Bibliography, Appendix.

[T1, T2][No. of Hrs. 10]

UNIT-III

Writing and Designing for Electronic Media: Use of Internet as a Writing tool; designing and writing for multimedia applications and the World Wide Web.

[T1, T2][No. of Hrs. 12]

UNIT-IV

Research and Writing Ethics: Explaining Forms and Consequences of Plagiarism, Introduction to Intellectual Property Right and Copy Right Laws.

[T1, T2][No. of Hrs. 11]

Text Book(s):

- [T1] Sides, Charles H., "How to Write and Present Technical Information", Cambridge Univ. Press, 1999.
[T2] Basu, B. N., "Technical Writing", PHI Learning Pvt. Ltd., 2007.

Reference Book(s):

- [R1] Beer, David F. and David A. McMurrey, "A Guide to Writing as an Engineer", New York: Wiley, 2005.
[R2] Gibaldi, Joseph, and Walter S. Achtert, "MLA Handbook for Writers of Research Papers, Thesis, and Dissertations", Modern Language Association, 1980.
[R3] Rubens, Philip, "Science and Technical Writing: A Manual of Style", Routledge, 2002.
[R4] Anderson, Marilyn, Pramod K. Nayar, and Madhucchandra Sen, "Critical Thinking, Academic Writing and Presentation Skills", Pearson. 2010.

The Scheme and Syllabus for B.Voc (Refrigeration and Air Conditioning) (3rd Year) has been approved in 45th BOS Meeting of USICT held on 16th March, 2017 and 43rd Academic Council Meeting held on 25th May, 2017. The Scheme and Syllabus is applicable for the batch admitted in the Academic Session 2016-17 onwards, w.e.f., 1st August, 2018

ADVANCED PSYCHROMETRY AND HEAT LOAD CALCULATION**Paper Code: ETVRA-701****L T/P C****Paper: Advanced Psychrometry and Heat Load Calculation****3 1 4****INSTRUCTIONS TO PAPER SETTER:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective & Pre-requisite: To introduce the students about the knowledge of principles of advanced Psychrometry and heat load calculation.

Learning Outcomes:**UNIT-I**

Concept of Advanced Psychrometry, effective sensible heat factor, cooling and dehumidification, cooling and dehumidification for high latent heat load application, cooling and humidification, sensible cooling, spray characteristics, evaporative cooling used with split system, heating and humidification –with spray, critical loading conditions.

[T1, T2, R1, R2][No. of Hrs.12]**UNIT-II**

Introduction to heat load estimation, building survey, design conditions, sources of load component-sensible and latent, skin load-solar gain through glass-solar and transmission gain through walls and roof, infiltration, ventilation.

[T1, T2, T3, R1][No. of Hrs.12]**UNIT-III**

Internal heat loads-people-lights-equipments, system heat gain-duct heat gain-duct air leakage-blower power.

[T1, T2, R4, R5][No. of Hrs.10]**UNIT-IV**

Concept of equivalent temperature difference, calculation of U factor, requirement of fresh air, simple heat load calculation.

[T1, T2, R3, R4, R5][No. of Hrs.11]**Text Book(s):**

- [T1] P. L. Ballaney, "Refrigeration & Air Conditioning", Khanna Publisher
 [T2] C.P Arora, "Refrigeration & Air Conditioning", Tata McGraw Hill
 [T3] P.N. Ananthanarayanan, "Refrigeration & Air Conditioning", Tata McGraw Hill

Reference Book(s):

- [R1] Pita, "Air Conditioning Principles & Systems", Prentice Hall of India Pvt. Ltd.
 [R2] Jones, "Air Conditioning", Tata McGraw Hill
 [R3] V. Paul Lang, "Principle of Air Conditioning", CBS
 [R4] ISHRAE Hand Book
 [R5] ASHRAE Hand Book

CRYOGENIC ENGINEERING
(Core Elective-II)

Paper Code: ETVRA-703
Paper: Cryogenic Engineering

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTER:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective & Pre-requisite: To introduce the students about the knowledge of principles of refrigeration and liquefaction, gas liquefaction systems and cryogenic equipment.

Learning Outcomes:

UNIT-I

Refrigeration and Liquefaction Principles: Joule Thomson effect and inversion curve; Adiabatic and isenthalpic expansion with their comparison. Properties of cryogenic fluids; Properties of solids at cryogenic temperatures, Superconductivity. Adiabatic Expansion - Liquefaction Systems for Air, Neon, Hydrogen and Helium - Effect of component efficiencies on System Performance.

[T1, T2, R1][No. of Hrs.11]

UNIT-II

Gas Liquefaction Systems: Recuperative – Linde – Hampson, Claude, Cascade, Heylandt, Kapitza, Collins, Simon; Regenerative – Stirling cycle and refrigerator, Slovac refrigerator, Gifford-McMahon refrigerator, Vuilleumier refrigerator, Pulse Tube refrigerator; Liquefaction of natural gas.

[T1, T2, R1][No. of Hrs.12]

UNIT-III

Storage of Cryogenic Liquids: Design considerations of storage vessel; Dewar vessels; Industrial storage vessels; Storage of cryogenic fluids in space; Transfer systems and Lines for cryogenic liquids; Cryogenic valves in transfer lines; Two phase flow in Transfer system; Cool-down of storage and transfer systems.

[T1, T2, R1][No. of Hrs.11]

UNIT-IV

Cryogenic Equipment: Cryogenic heat exchangers – recuperative and regenerative; Variables affecting heat exchanger and system performance; Cryogenic compressors, Pumps, expanders; Turbo alternators; Effect of component inefficiencies; System Optimization. Magneto-caloric refrigerator; 3He-4He Dilution refrigerator; Cryopumping Cryogenic Engineering applications in energy, aeronautics, space, industry, biology, preservation Application of Cryogenic Engineering in Transport.

[T1, T2, R1][No. of Hrs.11]

Text Books:

- [T1] Randall Baron, “Cryogenic System”, Tata McGraw Hill
[T2] K.D. Timmerhaus & T.M. Flynn, “Cryogenic Process Engineering”, Plenum Press

Reference Books:

- [R1] Russel B Scott, “Cryogenic Engineering”, Van Nostrand

VAPOUR ABSORPTION AND NON-CONVENTIONAL REFRIGERATION SYSTEM
(Core Elective-II)

Paper Code: ETVRA-705

Paper: Vapour Absorption and Non-Conventional Refrigeration System

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTER:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

***Objective & Pre-requisite:** To introduce the students about the knowledge of principles of vapour absorption and non-conventional refrigeration system.*

UNIT-I

Introduction to vapour absorption system, refrigerant-solvent properties, simple ammonia-water absorption system, practical ammonia-water absorption system, comparison between vapour absorption and vapour compression system.

[T1, T2, T3, R2][No. of Hrs.12]

UNIT-II

COP of an ideal vapour absorption system,, domestic electrolux (NH₃-H₂) refrigerator, Lithium Bromide absorption refrigeration system, Temperature-concentration diagram for binary mixture, Enthalpy-concentration diagram, adiabatic mixing of two streams.

[T1, T2, R3, R4][No. of Hrs.12]

UNIT-III

Thermoelectric effect, thermoelectric refrigeration system, materials used in thermoelectric refrigeration system, comparison between thermoelectric refrigeration and vapour compression system.

[T1, T2, R1, R2][No. of Hrs.10]

UNIT-IV

Vortex tube concept for cooling, pulse tube refrigeration system, adsorption refrigeration system, cooling by adiabatic demagnetization.

[T1, T2, R1, R2, R5][No. of Hrs.11]

Text Book(s):

- [T1] P. L. Ballaney, "Refrigeration & Air Conditioning", Khanna Publisher
 [T2] C.P Arora, "Refrigeration & Air Conditioning", Tata McGraw Hill
 [T3] P.N. Ananthanarayanan, "Refrigeration & Air Conditioning", Tata McGraw Hill

Reference Book(s):

- [R1] Pita, "Air Conditioning Principles & Systems", Prentice Hall of India Pvt. Ltd.
 [R2] Jones, "Air Conditioning", Tata McGraw Hill
 [R3] V. Paul Lang, "Principle of Air Conditioning", CBS
 [R4] ISHRAE Hand Book
 [R5] ASHRAE Hand Book

MEASUREMENT AND INSTRUMENTATION
(Core Elective-III)

Paper Code: ETVRA-707

Paper: Measurement and Instrumentation

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTER:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective & Pre-requisite: To introduce the students about the knowledge of principles of measurement and instrumentation.

UNIT-I

Principles of Measurement: Definition of Metrology, difference between precision and accuracy. Sources of errors: Controllable and Random Errors, Effects of Environment and Temperature, Effects of support, alignment errors, application of Least Square principles, errors in measurement of a quality which is function of other variables..

Length Standards: Line standards, end standards and wavelength standards, transfer from line standards to end standards. Numerical based on line standards. Slip gauges – its use and care.

Limits, fits and Tolerances: Various definitions, IS919-1963, different types of fits and methods to provide these fits. Numerical to calculate the limits, fits and tolerances as per IS 919-1963. ISO system of limits and fits; Gauges and its types, limit gauges – plug and ring gauges. Gauge Design – Taylor’s Principle, wear allowance on gauges.

[T1, T2, R1, R2, R3][No. of Hrs. 11]

UNIT-II

Comparators: Mechanical Comparators: Johanson Mikrokator and Sigma Mechanical Comparator. Mechanical optical comparator. Principles of electrical and electronic comparators. Pneumatic comparators – advantages, systems of Pneumatic gauging.

Angular Measurement: Sine Bar – different types of sine bars, use of sine bars in conjunction with slip gauges, precautions and calibration of sine bars.

[T1, T2, R1, R2, R3][No. of Hrs. 11]

UNIT - III

Straightness and Flatness: Definition of Straightness and Flatness error. Numericals based on determination of straightness error of straight edge with the help of spirit level and auto collimator. Numericals based on determination of flatness error of a surface plate with the help of spirit level or auto collimator. Surface texture, different types of irregularities, standard measures for assessment and measurement of surface finish.

Screw Thread Measurement: Errors in threads, Measurement of elements of screw threads –major dia, minor dia, pitch, flank angle and effective diameter (Two and three wire methods).

[T1, T2, R1, R2, R3][No. of Hrs. 11]

UNIT - IV

Interferometry: Principle of measurement, Interferometry applied to flatness testing, surface contour tests, optical flats, testing of parallelism of a surface with the help of optical flat

Introduction to Seismic Transducers - Displacement and acceleration measurement, Pressure measurement- Bourdon pressure gauge, bulk modulus gauge, pirani gauge.

[T1, T2, R1, R2, R3][No. of Hrs. 10]

Text Book(s):

[T1] R.K. Jain, “Engineering Metrology”, Khanna Publishers, Delhi

[T2] I.C. Gupta, “Engineering Metrology”, Dhanpat Rai Publications, Delhi

Reference Book(s):

[R1] F.W. Galyer & C.R. Shotbolt, “Metrology for Engineers”, ELBS Edition

[R2] Beckwith, Buck, Lienhard, “Mechanical Measurements”, Pearson Education

[R3] Anand K Bewoor, Vinay A Kulkarni, “Metrology and Measurement”, TMH

PIPE DESIGN AND PUMP SELECTION
(Core Elective-III)

Paper Code: ETVRA-709

Paper: Pipe Design and Pump Selection

L	T/P	C
3	1	4

INSTRUCTIONS TO PAPER SETTER:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective & Pre-requisite: To introduce the students about the knowledge of principles of pipe design and pump selection.

UNIT-I

Different types of pipe systems, water return arrangement, pumping system-single pumping, primary/secondary/tertiary.

Pumps-classification-monoblock pump, back pull out pump, split casing pump. Working principle of centrifugal pump. Casing of pump-volute casing, vortex casing, diffuser casing. Material of different component of pump.

[T1, T2, T3, R1, R2, R3, R4][No. of Hrs. 12]

UNIT-II

Application of Bernoulli's theorem, pressure head, velocity head, datum head. Pump power. Net Positive Suction Head (NPSH). Series and parallel arrangement of pumps, system and pump curve, Muschel curve, affinity laws, concept of variable speed pumping.

[T1, T2, T3, R1, R2, R3, R4][No. of Hrs. 11]

UNIT-III

Friction loss in straight pipe, Froude friction law for laminar and turbulent flow, Darcy Weisbach formula, Moodies friction chart, pressure drop in fittings, velocity in pipe, water flow rate in condenser water circuit, chilled water circuit, hot water circuit.

[T1, T2, T3, R1, R2, R3, R4][No. of Hrs. 12]

UNIT-IV

Expansion tank, valves and accessories-butterfly valve, ball valve, balancing valve, non-return valve, gate valve, globe valve, cock valve, water strainer, water pressure gauge, water flow switch, flow meter.

[T1, T2, T3, R1, R2, R3, R4, R5][No. of Hrs. 10]

Text Book(s):

[T1] P. L. Ballaney, "Refrigeration & Air Conditioning", Khanna Publisher

[T2] C.P Arora, "Refrigeration & Air Conditioning", Tata McGraw Hill

[T3] P.N. Ananthanarayanan, "Refrigeration & Air Conditioning", Tata McGraw Hill

Reference Book(s):

[R1] Pita, "Air Conditioning Principles & Systems", Prentice Hall of India Pvt. Ltd.

[R2] Jones, "Air Conditioning", Tata McGraw Hill

[R3] V.Paul Lang, "Principle of Air Conditioning", CBS

[R4] ISHRAE Hand Book

[R5] ASHRAE Hand Book

NCC/ NSS/ SPORTS/ COMMUNITY SERVICES/ ECO CLUB
(General Elective-II)

Paper Code: ETVSS-751/ 753/ 755/ 757/ 759

L	T/P	C
0	2	1

Paper: NCC/NSS/ Sports/ Community Services/ ECO Club

Students should actively participate in either of the above activities of the institute during academic session. Credits shall be awarded accordingly based on final assessment by internal institute committee constituted by the Principal/ Director of the respective institutes. Students are encouraged organize events and awards if any shall be distributed to students during annual day/ specific function day accordingly



GURU GOBIND SINGH
INDRAPRASTHA
UNIVERSITY

YOGA
(General Elective-II)

Paper Code: ETVSS-761
Paper: Yoga

L	T/P	C
0	2	1

INSTRUCTIONS TO PAPER SETTERS:

MAXIMUM MARKS: 75

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit

Introduction: Yoga education in Schools/Colleges/ Institutions/ Organizations/Universities etc. can immensely contribute to health of children by disseminating knowledge and awareness about the value of health, inculcating and nurturing health promoting habits and life style.

The Paper on YOGA has been initiated by USET for the students in a new skill development programme known as B.Voc programme. Currently, launched in 09 Govt. Institutions affiliated to GGSIP University.

Aim and Objectives:

The aim of the Paper is to introduce Yoga. The specific objectives are:

- To impart Yoga education in schools/colleges/Institutions for prevention of disease and promotion of health;
- To train faculty members in Yogic principles and practices.
- To prepare and distribute standardized Yoga teaching and training materials with reference to institute health.

UNIT-I

- ❖ Brief introduction to origin of Yoga, Psychological aspects leading to origin of Yoga, Hindu Mythological concepts about origin of Yoga
- ❖ History and Development of Yoga
- ❖ Etymology and Definitions of Yoga, Aim and Objectives of Yoga, Misconceptions about Yoga, True Nature of Yoga
- ❖ General Introduction to Schools of Yoga
- ❖ Principles of Yoga, Yoga Practices for Health and Harmony

UNIT-II

Yoga Traditions and Classical Schools of Yoga.

- ❖ Yoga's Traditional Source
- ❖ Different's traditions of Yoga.
- ❖ Contemporary Yoga Practice.
- ❖ Concepts and Practices of Yoga in others religions.

UNIT-III

Experimental Study Yoga:

- ❖ Aasan, Surya Namaskar, Pranayam, Sukshm-Kriya, Dhyan-Mudra, Shatkarma

UNIT-IV

Yoga and You

- ❖ **Concept of Health-** Aahaar, Nidra, Bharmacharaya, Viyayaam.
- ❖ **Aarogya** - Prevention, Cure and Remedies.
- ❖ Life Management and Development.

Reference Book(s)

- [R1] Singh S. P & Yogi Mukesh, "Foundation of Yoga", Standard Publication, New Delhi, 2010
 [R2] Radhakrishnan S, "Indian Philosophy", (Vol. I & II) II Edition, Oxford University, UK, 2008.
 [R3] Swami Devvarata, "Ashtang Yog", 119, Guttam Nagar.
 [R4] Prof. Ram Harsh Singh, "Swasth Viritam"
 [R5] Swami Prabhavanand, "Spiritual Heritage of India (English)", Sri Ramkrishna Math, Madras, 2004

The Scheme and Syllabus for B.Voc (Refrigeration and Air Conditioning) (3rd Year) has been approved in 45th BOS Meeting of USICT held on 16th March, 2017 and 43rd Academic Council Meeting held on 25th May, 2017. The Scheme and Syllabus is applicable for the batch admitted in the Academic Session 2016-17 onwards, w.e.f., 1st August, 2018

**YOGA PRACTICAL
I.A**

I. RECITATION OF HYMNS & HASTA MUDRA

- 1.1 Recitation of Pratah-smaran and Shanti Mantras
- 1.2 Recitation of Pranava Japa and Soham Japa
- 1.3 Recitation of Hymns from Upanishad & Yoga Texts
- 1.4 Hasta Mudra: Chin, Jnana, Hridaya, Bhairav, Yoni

II. SHATKARMA

- 2.1 Dhauti (Kunjali, Vamana Dhauti, Vastra Dhauti)
- 2.2 Neti (Jalneti, Sutraneli)
- 2.3 Kapalabhati and its variants
- 2.4 Agnisara

III. BREATHING PRACTICES

- 3.1 Breath Awareness: Shwas-prashwas Sanyaman
- 3.2 Abdomen, Thoracic & Clavicular Breathing, Abdomen + Thoracic Breathing, Abdomen + Thoracic + Clavicular Breathing
- 3.3 Yogic Breathing: Pause Breathing (Viloma Pranayama), Spinal Passage Breathing (Sushumna Breathing)
- 3.4 Practice of Puraka, Rechaka & Kumbhaka (Antar & Bahya Kumbhaka)

GURU GOBIND SINGH
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UNIVERSITY

YOGA PRACTICAL
I.B

YOGIC SUKSMA AND STHULA VYAYAMA, NABHI PAREEKSHA

1.1 YOGIC SUKSMA VYAYAMA

1. Uccharana-sthalatatha Vishudha-chakra-shuddhi (for throat and voice)
2. Prarthana (Prayer)
3. Buddhi-tatha-dhritishakti-vikasaka (for developing will power)
4. Smaranashakti-vikasaka (for improving the memory)
5. Medhashakti-vikasaka (for improving the intellect and memory)
6. Netrashakti-vikasaka (for the eyes)
7. Kapolashakti-varadhaka (for the cheeks)
8. Karnashakti-varadhaka (for the ears)
9. Grivashakti-vikasaka (for the Neck) (i) (A & B)
10. Grivashakti-vikasaka (for the Neck) (ii) (A & B)
11. Grivashakti-vikasaka (for the Neck) (iii)
12. Skandha-tatha-bahu-mulashakti-vikasaka (for the shoulders)
13. Bhuja-bandhashakti-vikasaka
14. Kohinishakti-vikasaka
15. Bhuja-vallishakti-vikasaka
16. Purna-bhujashakti-vikasaka (for the arms)
17. Mani-bandhashakti-vikasaka
18. Kara-prsthashakti-vikasaka
19. Kara-talashakti-vikasaka
20. Anguli-mulashakti-vikasaka (for the fingers) (A & B)
21. Anguli- shakti-vikasaka (for the fingers) (A & B)
22. Vaksha-sthalashakti-vikasaka (for the chest) (1)
23. Vaksha-sthalashakti-vikasaka (for the chest) (2)
24. Udarashakti-vikasaka (for the abdomen) (i)
25. Udarashakti-vikasaka (for the abdomen) (ii)
26. Udarasakti-vikasaka (for the abdomen) (iii)
27. Udarashakti-vikasaka (for the abdomen) (iv)
28. Udarashakti-vikasaka (for the abdomen) (v)
29. Udarashakti-vikasaka (for the abdomen) (vi)
30. Udarashakti-vikasaka (for the abdomen) (vii)
31. Udarashakti-vikasaka (for the abdomen) (viii)
32. Udarashakti-vikasaka (for the abdomen) (ix)
33. Udarashakti-vikasaka (for the abdomen) (x) (A, B & C)
34. Kati shakti-vikasaka (for the waist) (i)
35. Kati shakti-vikasaka (for the waist) (ii)
36. Kati shakti-vikasaka (for the waist) (iii)

37. Kati shakti-vikasaka (for the waist) (iv)
38. Kati shakti-vikasaka (for the waist) (v)
39. Muladhara-chakra-suddhi (for the rectum)
40. Upasthatatha-svadhithana-chakra-suddhi (for the genital organs)
41. Kundalinishakti-vikasaka (for the kundalini)
42. Janghashakti-vikasaka (for the thighs) (i) (A & B)
43. Janghashakti-vikasaka (for the thighs) (ii) (A & B)
44. Janushakti-vikasaka (for the knees)
45. Pindalishakti-vikasaka (for the calves)
46. Pada-mulashakti-vikasaka (A & B)
47. Gulpha-pada-pristha-pada-tala-shakti-vikasaka (for the ankles and the feet)
48. Padangulishakti-vikasaka (for the toes)

1.2 YOGIC STHULA VYAYAMA

1. Rekha-gati (Walking in a Straight line)
2. Hrid-gati (Injanadaur – the Locomotive Exercise)
3. Utkurdana (Jumping Exercise)
4. Urdhva-gati (Upward Movement)
5. Sarvanga-pusti (Developing the Entire body) &

1.3 NABHI PAREEKSHA

II. SURYA NAMASKARA

III. YOGASANA (Standing Postures and body alignment)

- 3.1 Tadasana, Vrikshasana, Urdhva-Hastottanasana, Kati Chakrasana
- 3.2 ArdhaChakrasana, Paada Hastasana
- 3.3 Trikonasana, Parshva Konasana
- 3.4 Veerabhadrasana and its variations

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YOGA PRACTICAL
II.A

I. SHATKARMA

1.1 Dhauti

1.2 Neti

1.3 Nauli Madhyama, Vama, Dakshina and Nauli Chalana

1.4 Trataka (Jatru and Jyoti)

II. PRANAYAMA

2.1 Nadi Shodhana (Technique 1: Same Nostril Breathing)

2.2 Nadi Shodhana (Technique 2: Alternate Nostril Breathing)

2.3 Nadi Shodhana (Technique 3: Alternate Nostril Breathing + Antar Kumbhak)

2.4 Nadi Shodhana (Puraka + Antar Kumbhak + Rechaka + Bahya Kumbhak) (1:4:2:2)

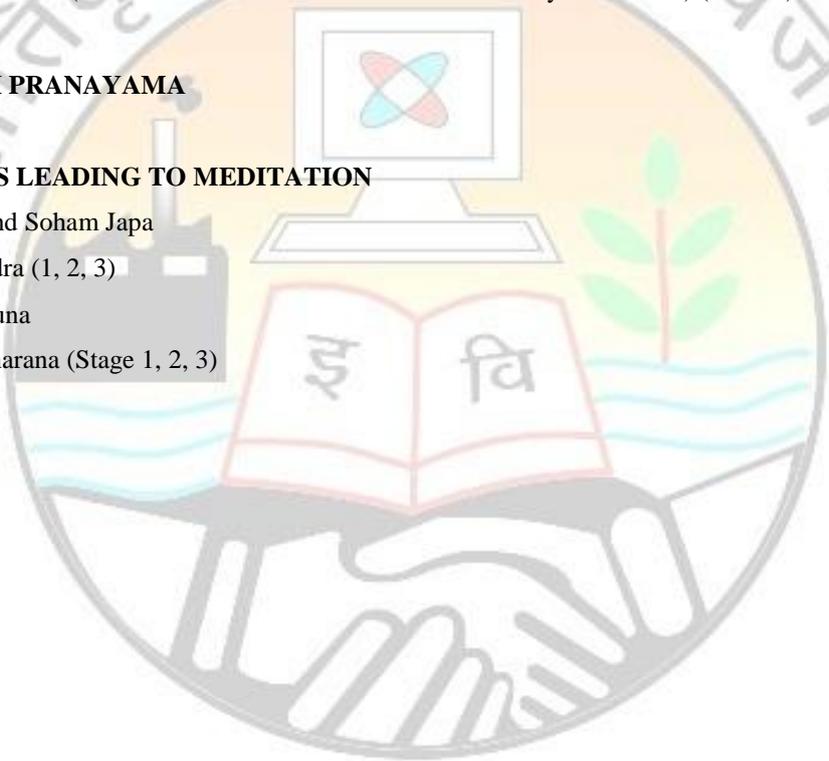
2.5 BHRAMARI PRANAYAMA**III. PRACTICES LEADING TO MEDITATION**

3.1 Pranav and Soham Japa

3.2 Yoga Nidra (1, 2, 3)

3.3 Antarmauna

3.4 Ajapa Dharana (Stage 1, 2, 3)



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YOGA PRACTICAL
II.B

I. YOGASANA (Sitting Postures)

- 1.1 Dandasana, Swastikasana, Padmasana, Vajrasana, Supta Vajrasana
 1.2 Kagasana, Utkatasana, Gomukhasana, Ushtrasana, Shashankasana,
 1.3 Janusirasana, Paschimottanasana, Bhramacharyasana, Mandukasana, Utthana Mandukasana
 1.4 Vakrasana, Ardha Matsyendrasana, Marichayasana, Simhasana

II. YOGASANA (Supine lying Postures)

- 2.1 Pavanamuktasana
 2.2 Utthana-padasana, Ardha Halasana,
 2.3 Halasana
 2.4 Setubandha Sarvangasana
 2.5 Sarvangasana
 2.6 Matsyasana
 2.7 Chakrasana
 2.8 Shavasana

III. YOGASANA (Prone lying Postures)

- 3.1 Makarasana
 3.2 Bhujangasana
 3.3 Shalabhasana
 3.4 Dhanurasana
 3.5 Kapotasana
 3.6 Raja Kapotasana

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YOGA PRACTICAL
III.A

I. BANDHA

- ❖ Jivha Bandha
- ❖ Jalandhara Bandha
- ❖ Uddiyana Bandha
- ❖ Mula Bandha
- ❖ Maha Bandha
- ❖ Tri Bandha

II PRANAYAMA (with Antar & Bahya Kumbhaka)

- 2.1 Surya-bhedi and Chandra-bhedi Pranayama
- 2.2 Ujjayi Pranayama
- 2.3 Sheetali Pranayama
- 2.4 Shitkari Pranayama
- 2.5 Bhastrika Pranayama

III. PRACTICES LEADING TO MEDITATION

- 3.1 Ajapa Dharana (Stage 4, 5, 6)
- 3.2 Yoga Nidra (4, 5)
- 3.3 Practices leading to Breath Meditation
- 3.4 Practices leading to Om Meditation
- 3.5 Practices leading to Vipassana Meditation

Practices leading to Preksha Meditation

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YOGA PRACTICAL
III.B

I. YOGASANA

- 1.1 Siddhasana, Bhadrasana,
- 1.2 Baddha Padmasana, Uttitha Padmasana,
- 1.3 Bhunamanasana, Hanumanasana
- 1.4 Bakasana, Kukkutasana, Garbhasana
- 1.5 Matsyendrasana, Marjariasana,
- 1.6 Padangusthasana, Hastapadangusthasana
- 1.7 Garudasana, Vatayanasana, Natarajasana
- 1.8 Mayurasana, Padma Mayurasana
- 1.9 Sirshasana and its variations
- 1.10 Ekapada and Dwipada Kandarasana

II. MUDRAS

- 2.1 Yoga Mudra
- 2.2 Maha Mudra
- 2.3 Shanmukhi Mudra
- 2.4 Shambhavi Mudra
- 2.5 Kaki Mudra
- 2.6 Tadagi Mudra
- 2.7 Vipareet Karni Mudra
- 2.8 Simha Mudra

GURU GOBIND SINGH
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UNIVERSITY

CRYOGENIC ENGINEERING LAB
(Core Elective-II)

Paper Code: ETVRA-753
Paper: Cryogenic Engineering Lab

L	T/P	C
0	3	3

Note:- The required list of Experiments is provided as under. The example cited here are purely indicative and not exhaustive. Attempt shall be made to perform all experiments. However, at least 8 experiments should be done in the semester. More experiments may be designed by the respective institutes as per their choice.

List of Experiments:

1. Visit to Nitrogen or other gas liquefaction plant.
2. Prepare plant layout showing sequence of different components
3. Prepare block diagram of sequence of operations of the plant
4. Prepare safety guidelines
5. Prepare a list of your observation



GURU GOBIND SINGH
INDRAPRASTHA
UNIVERSITY

VAPOUR ABSORPTION AND NON-CONVENTIONAL REFRIGERATION SYSTEM LAB
(Core Elective-II)

Paper Code: ETVRA-755

Paper: Vapour Absorption and Non-Conventional Refrigeration System Lab

L	T/P	C
0	3	3

Note:- The required list of Experiments is provided as under. The example cited here are purely indicative and not exhaustive. Attempt shall be made to perform all experiments. However, at least 8 experiments should be done in the semester. More experiments may be designed by the respective institutes as per their choice.

List of Experiments:

1. Visit to vapour absorption based refrigeration plant
2. Prepare plant layout showing sequence of different components
3. Prepare block diagram of sequence of operations of the plant
4. Prepare safety guidelines
5. Prepare a list of your observation



**GURU GOBIND SINGH
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MEASUREMENT AND INSTRUMENTATION LAB
(Core Elective-III)

Paper Code: ETVRA-757

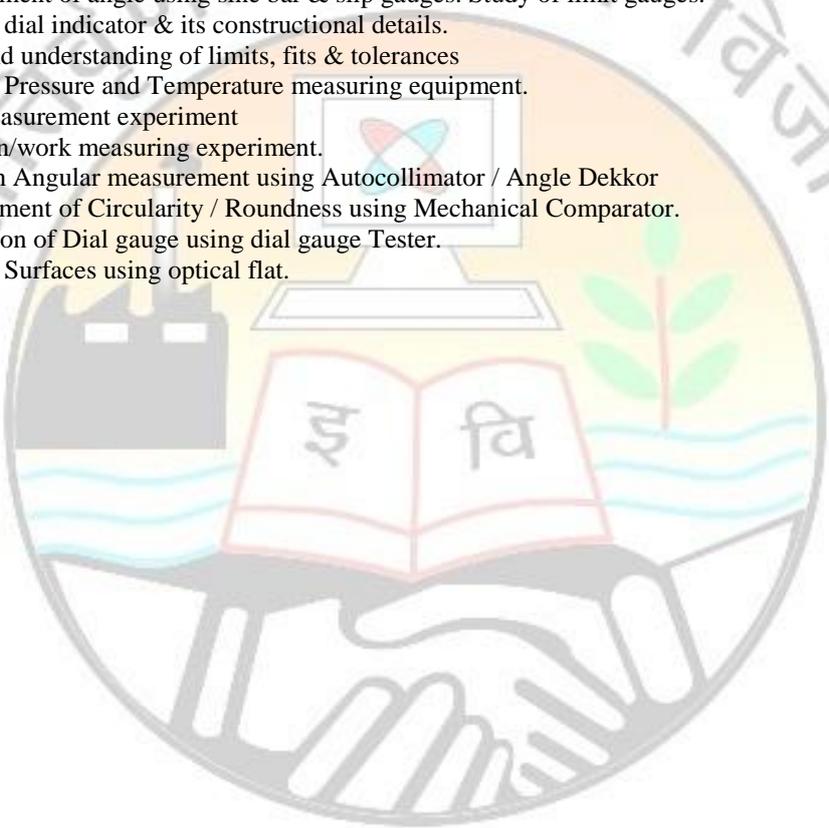
Paper: Measurement and Instrumentation Lab

L	T/P	C
0	3	3

Note:- The required list of Experiments is provided as under. The example cited here are purely indicative and not exhaustive. Attempt shall be made to perform all experiments. However, at least 8 experiments should be done in the semester. More experiments may be designed by the respective institutes as per their choice.

List of Experiments:

1. Study & working of simple measuring instruments - Vernier calipers, micrometer, tachometer.
2. Measurement of effective diameter of a screw thread using 3 wire methods.
3. Measurement of angle using sine bar & slip gauges. Study of limit gauges.
4. Study of dial indicator & its constructional details.
5. Study and understanding of limits, fits & tolerances
6. Study of Pressure and Temperature measuring equipment.
7. Flow measurement experiment
8. Vibration/work measuring experiment.
9. Precision Angular measurement using Autocollimator / Angle Dekkor
10. Measurement of Circularity / Roundness using Mechanical Comparator.
11. Calibration of Dial gauge using dial gauge Tester.
12. Study of Surfaces using optical flat.



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PIPE DESIGN AND PUMP SELECTION LAB
(Core Elective-III)

Paper Code: ETVRA-759

Paper: Pipe Design and Pump Selection Lab

L	T/P	C
0	3	3

Note:- The required list of Experiments is provided as under. The example cited here are purely indicative and not exhaustive. Attempt shall be made to perform all experiments. However, at least 8 experiments should be done in the semester. More experiments may be designed by the respective institutes as per their choice.

List of Experiments:

1. Site visit of central air-conditioning (using chilled water) building e.g. hotel, hospital, residential complex, office and college etc.
2. Site visit to have knowledge of layout of piping arrangement
3. Site visit to have knowledge of layout of pipe fittings e.g. valves, elbows etc.
4. Site visit to have knowledge of pumping system
5. Calculation of pipes diameter and calculation of total friction loss
6. Selection of pump



GURU GOBIND SINGH
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UNIVERSITY

LANGUAGE LAB
(Common to all Disciplines)

Paper Code: ETVHS-751
Paper: Language Lab

L	T/P	C
0	3	3

Note:- The required list of Experiments is provided as under. The example cited here are purely indicative and not exhaustive. Attempt shall be made to perform all experiments. However, at least 8 experiments should be done in the semester. More experiments may be designed by the respective institutes as per their choice.

List of Exercises:

- 1. Fundamentals of Inter-personal Communication and Building Vocabulary**
 - Self introduction and introducing others
 - Situational Dialogues: Starting a dialogue and responding relevantly & appropriately
 - Role-Play-Expressions in various situations
 - Social and Professional Etiquette: greetings, apologies, requests etc
 - Telephone Etiquette.
- 2. Non-verbal Communication**
 - Gesture, posture and body language
 - Facial Expressions.
 - Paralinguistic Skills
 - Proxemics
 - Eye Gaze.
 - Haptics
 - Appearance.
- 3. Reading Comprehension and Listening Exercise**
 - General vs Local Comprehension
 - Skimming, Scanning
 - Inference drawing
 - Critical reading
 - Listening , Hearing
- 4. Presentation Skills**
 - Oral presentation
 - Seminar/ conference Paper Presentation
 - PPTs and Written presentation through poster/projects/reports/e-mails/assignments etc
 - Camera ready presentation
- 5. Group Discussion**
 - Dynamics of Group Discussion
 - Intervention
 - Summarizing
 - Body Language and Voice, Intonation
- 6. Interview Skills**
 - Interview etiquette
 - Body posture and body language
 - Voice, intonation and modulation
 - Fluency and organization of ideas
 - Rubrics for evaluation: Concept and process, pre-interview planning, opening strategies, answering techniques,
 - Interview through tele-conferencing and video-conferencing
 - Mock interview
 - Campus placement interview
- 7. Public and Professional Speaking**
 - Extempore
 - Public Speech
 - Professional speech/lecture
- 8. Articulation and Management**
 - Time management
 - Articulation and expression
 - Assertiveness
 - Psychometrics
 - Stress management

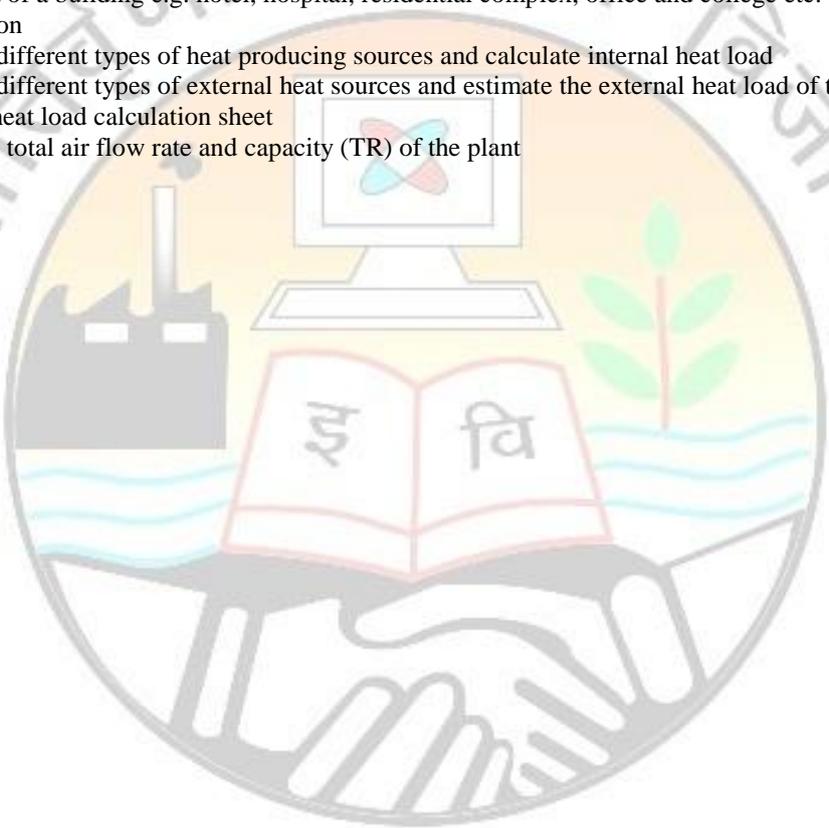
ADVANCED PSYCHROMETRY AND HEAT LOAD CALCULATION LAB**Paper Code: ETVRA-751****L T/P C****Paper: Advanced Psychrometry and Heat Load Calculation Lab****0 3 3**

Note:- The required list of Experiments is provided as under. The example cited here are purely indicative and not exhaustive. Attempt shall be made to perform all experiments. However, at least 8 experiments should be done in the semester. More experiments may be designed by the respective institutes as per their choice.

List of Experiments:

Develop at least one heat load calculation sheet and estimate total heat load required for any central air conditioning building.

1. Site visit of a building e.g. hotel, hospital, residential complex, office and college etc. and plan its orientation
2. List out different types of heat producing sources and calculate internal heat load
3. List out different types of external heat sources and estimate the external heat load of the same building
4. Fill the heat load calculation sheet
5. Estimate total air flow rate and capacity (TR) of the plant



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UNIVERSITY

DUCT DESIGN AND AIR DISTRIBUTION**Paper Code: ETVRA-702****L T/P C****Paper: Duct Design and Air Distribution****3 0 3****INSTRUCTIONS TO PAPER SETTER:****MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective & Pre-requisite: To introduce the students about the knowledge of principles of duct design and air distribution.

UNIT-I

Introduction to duct, aspect ratio, concept of perimeter and cross sectional area ratio, comparison between round, square and rectangular duct, concept of velocity head, pressure head and potential head. Role of Bernoulli's theorem in duct, absolute and gauge pressure, measurement of pressure in duct.

[T1, T2, T3, R1, R2, R3, R4][No. of Hrs. 11]**UNIT-II**

Calculation of friction loss by darcyweisbach and Fritzsche formula, Moody friction chart, fitting loss, concept of equivalent length for different fittings. Rectangular equivalent of circular duct, duct material, classification of ducts-low pressure, medium pressure and high pressure.

[T1, T2, T3, R1, R2, R3, R4, R5][No. of Hrs. 11]**UNIT-III**

Duct designing methods-velocity reduction method, equal friction method and static regain method. Calculation based on these methods.

[T1, T2, T3, R1, R2, R3, R4][No. of Hrs. 11]**UNIT-IV**

Room air distribution and different parameters, conda effect, different types of air outlets grille, diffusers etc., location of supply and return grilles, duct insulation ,fire dampers, noise in ducts, duct standards-IS,SMACNA, DW144, DEF STAN.

[T1, T2, T3, R1, R2, R3, R5][No. of Hrs. 11]**Text Book(s):**

- [T1] P. L. Ballaney, "Refrigeration & Air Conditioning", Khanna Publisher
 [T2] C.P Arora, "Refrigeration & Air Conditioning", Tata McGraw Hill
 [T3] P.N. Ananthanarayanan, "Refrigeration & Air Conditioning", Tata McGraw Hill

Reference Book(s):

- [R1] Pita, "Air Conditioning Principles & Systems", Prentice Hall of India Pvt. Ltd.
 [R2] Jones, "Air Conditioning", Tata McGraw Hill
 [R3] V.Paul Lang, "Principle of Air Conditioning", CBS
 [R4] ISHRAE Hand Book
 [R5] ASHRAE Hand Book

COMMERCIAL SYSTEM
(Core Elective-IV)

Paper Code: ETVRA-704
Paper: Commercial System

L	T/P	C
3	0	3

INSTRUCTIONS TO PAPER SETTER:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective & Pre-requisite: To introduce the students about the knowledge of principles of commercial system.

UNIT-I

Introduction of refrigerator, working of different components of refrigerator, introduction of water cooler and deep freeze, window A/C, split A/C, package air conditioner, ductable A/C.

[T1, T2, T3, R1, R2, R3, R4, R5][No. of Hrs. 11]

UNIT-II

Detail study of ice plant.

[T1, T2, T3, R1, R2, R3, R4][No. of Hrs. 10]

UNIT-II

Introduction to food preservation, food spoilage factors, methods of food preservation, methods of food freezing, freeze drying, some applications-candy-milk and butter-meat products-poultry products-fishery products-fruits and vegetables.

[T1, T2, R1, R2, R3, R4, R5][No. of Hrs. 12]

UNIT-IV

Detail study of cold storage.

[T1, T2, T3, R1, R2, R3, R4, R5][No. of Hrs. 12]

Text Book(s):

- [T1] P. L. Ballaney, "Refrigeration & Air Conditioning", Khanna Publisher
 [T2] C.P Arora, "Refrigeration & Air Conditioning", Tata McGraw Hill
 [T3] P.N. Ananthanarayanan, "Refrigeration & Air Conditioning", Tata McGraw Hill

Reference Book(s):

- [R1] Pita, "Air Conditioning Principles & Systems", Prentice Hall of India Pvt. Ltd.
 [R2] Jones, "Air Conditioning", Tata McGraw Hill
 [R3] V.Paul Lang, "Principle of Air Conditioning", CBS
 [R4] ISHRAE Hand Book
 [R5] ASHRAE Hand Book

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ENERGY CONSERVATION AND AUDIT
(Core Elective-IV)

Paper Code: ETVRA-706

L	T/P	C
3	0	3

Paper: Energy Conservation and Audit

INSTRUCTIONS TO PAPER SETTER:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective & Pre-requisite: To introduce the students about the knowledge of principles of energy conservation and audit.

UNIT-I

Energy Audit Methodology and recent trends: General Philosophy, need of Energy Audit and Management. Definition and Objective of Energy Management, General Principles of Energy Management. Energy Management Skills, Energy Management Strategy. Economics of implementation of energy optimization projects, it's constraints, barriers and limitations, Report-writing, preparations and presentations of energy audit reports, Post monitoring of energy conservation projects. Case-Studies.

[T1, T2, T3, T4, T5, R1, R2][No. of Hrs. 11]

UNIT-II

Electrical Distribution and Utilization: Electrical Systems, Transformers loss reductions, parallel operations, T & D losses, P.F. improvements, Demand Side management (DSM), Load Management, Harmonics & its improvements, Energy efficient motors and Soft starters, Automatic power factor Controllers, Variable speed drivers, Electronic Lighting ballasts for Lighting, LED Lighting, Trends and Approaches. Study of 4 to 6 cases of Electrical Energy audit and management (Power factor improvement, Electric motors, Fans and blowers, Cooling Towers, Industrial/Commercial Lighting system, etc.)

[T2, T3, T4, T5, R1, R3][No. of Hrs. 11]

UNIT-III

Thermal Systems: Boilers- performance evaluation, Loss analysis, Water treatment and its impact on boiler losses, integration of different systems in boiler operation. Advances in boiler technologies, FBC and PFBC boilers, Heat recovery Boilers- it's limitations and constraints. Furnaces- Types and classifications, applications, economics and quality aspects, heat distributions, draft controls, waste heat recovering options, Furnaces refractory- types and sections. Thermic Fluid heaters, need and applications, Heat recovery and its limitations. Insulators- Hot and Cold applications, Economic thickness of insulation, Heat saving and application criteria.

[T1, T3, T4, R1, R2][No. of Hrs. 11]

UNIT-IV

System Audit of Mechanical Utilities: Pumps, types and application, unit's assessment, improvement option, parallel and series operating pump performance. Energy Saving in Pumps & Pumping Systems. Bloomers (Blowers) types & application, its performance assessment, series & parallel operation applications & advantages. Energy Saving in Blowers Compressors, types & applications, specific power consumption, compressed air system & economic of system changes. Energy Saving in Compressors & Compressed Air Systems Cooling towers, its types and performance assessment & limitations, water loss in cooling tower. Energy Saving in Cooling Towers .Study of 4 to 6 cases of Energy Audit & Management in Industries (Boilers, Steam System, Furnaces, Insulation and Refractory, Refrigeration and Air conditioning.

[T1, T3, T4, T5, R1, R3][No. of Hrs. 12]

Text Book(s):

- [T1] "Energy Audit and Management", Volume-I, IECC Press
 [T2] "Energy Efficiency in Electrical Systems", Volume-II, IECC Press
 [T3] W.R. Murphy, G. McKay, "Energy Management", Butterworths Scientific
 [T4] C. B. Smith, "Energy Management Principles", Pergamon Press
 [T5] D.A. Reay, "Industrial Energy Conservation", Pergamon Press

Reference Book(s):

- [R1] W.C. Turner, "Energy Management Handbook", John Wiley and Sons, Wiley Interscience

The Scheme and Syllabus for B.Voc (Refrigeration and Air Conditioning) (3rd Year) has been approved in 45th BOS Meeting of USICT held on 16th March, 2017 and 43rd Academic Council Meeting held on 25th May, 2017. The Scheme and Syllabus is applicable for the batch admitted in the Academic Session 2016-17 onwards, w.e.f., 1st August, 2018

- [R2] L.C. Witte, P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilization", Hemisphere Publication, Washington, 1988
- [R3] Albert Thumann, P.E., C.E.M. William J. Younger, "Hand Book of Energy Audits", C.E.M., CRC Press



AUTOMOBILE AIR-CONDITIONING
(Core Elective-V)

Paper Code: ETVRA-708

L	T/P	C
3	0	3

Paper: Automobile Air-Conditioning

INSTRUCTIONS TO PAPER SETTER:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective & Pre-requisite: To introduce the students about the knowledge of principles of energy conservation and audit.

UNIT-I**Fundamental principles and various Definitions**

Heat and Modes of heat transfer, Latent Heat, Sensible Heat, Air circulation and Humidity, Cooling the air, Drying and cleaning the air. Basic Air-conditioning systems and operation of basic components - Magnetic clutch- Receiver Drier and Filter- Automotive air-conditioning controls- Working of different automotive heaters.

[T1, T2, R1, R2, R3][No. of Hrs. 11]

UNIT-II

Manually controlled air-conditioner heater systems- Different types of air-conditioner heater systems.-Working and its operating modes- Automatically controlled Air-conditioning systems-Automatic temperature control- Operating modes-Different parts of automatic controlled air conditioning system.-Humidity Control (Humidifier and Dehumidifier)-Field installed air-conditioners-Automatic climate control.

[T1, T2, R1, R2, R3][No. of Hrs. 11]

UNIT-III

Safety in the shop- Fire prevention- Shop safety rules - Air-conditioner service safety rules. Servicing heating system - Car heater system trouble diagnosis chart. Causes of Air-conditioner failure. Trouble shooting the Air-conditioner system- Checking out a trouble - Air-conditioner trouble - diagnosis chart
Checking the refrigeration system- Checking system with sight glass-Using the Leak detector - Checking pressures with the gauge set.

[T1, T2, R1, R2, R3][No. of Hrs. 11]

UNIT-IV

Air-conditioner maintenance and service-Periodic maintenance-Vacuum pump service-Discharging the system - Adding oil-Evacuating the system -Vapour charging and Liquid charging Methods-Use of Recovery recharging unit. Removing and replacing components-O- rings-Hose clamps - Compressor drive belts - Removing and replacing the compressor - Removing and replacing other components. Servicing Air-conditioner compressors - Servicing different types compressors.

[T1, T2, R1, R2, R3][No. of Hrs. 12]

Text Book(s):

- [T1] Anil Chhikara, "Automobile Engineering", (Volume-VI), Satya Prakashan
[T2] William H. Carouse and Donald L. Anglin, "Automotive Air-Conditioning", Tata Mc Graw Hill

Reference Book(s):

- [R1] Clifford L. Samuels, "Automotive Air-Conditioning", Prentice Hall Int'l.
[R2] Steven Daly, "Automotive Air-Conditioning and Climate Control System", Butterworth-Heinemann
[R3] Mark Schnubel, "Automotive Heating and Air Conditioning", Cengage Publication.

NON-CONVENTIONAL ENERGY RESOURCES
(Core Elective-V)

Paper Code: ETVRA-710

L	T/P	C
3	0	3

Paper: Non-Conventional Energy Resources

INSTRUCTIONS TO PAPER SETTER:**MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question. No. 1 rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks.

Objective & Pre-requisite: To introduce the students about the knowledge of principles of non conventional energy resources.

UNIT-I

Solar Energy: radiation – extra terrestrial, spectral distribution, solar constant, solar radiation on earth, measurements; solar thermal system – solar thermal power and its conversion, solar collectors, flat plate, solar concentrating collectors, - types and applications; photovoltaic (PV) technology - photovoltaic effect, efficiency of solar cells, semi-conductor materials, solar PV system, standards and applications, tracking.

[T1, T2, R1, R2, R3, R4][No. of Hrs. 11]

UNIT-II

Wind and Small Hydropower Energy: wind data, properties, speed and power relation, power extracted, wind distribution and speed prediction, wind map of India; wind turbines and electric generators.

Fundamentals–Types of machines and their characteristics, horizontal and vertical wind mills, elementary design principle, wind energy farms, off-shore plants; small, mini and micro hydro power plants and their resource assessment, plant layout with major components shown.

[T1, T2, R5][No. of Hrs. 11]

UNIT- III

Other Non-conventional Energy Sources: Biomass – photosynthesis and origin of biomass energy, resources, cultivated resources, waste to biomass, terms and definitions – incineration, wood and wood waste, harvesting super tree, energy forest, pyrolysis, thermo-chemical biomass conversion to energy, gasification, anaerobic digester, fermentation, gaseous fuel; geothermal – resources, hot spring, steam system, principle of working, site selection, associated problems in development; ocean and tidal energy – principle of ocean thermal energy conversion, wave energy conversion machines, problems and limitations, fundamentals of tidal power, conversion systems and limitations; hydrogen energy – properties of hydrogen, sources, production and storage, transportation, problems for use as fuel; fuel cells – introduction with types, principle of operation and advantages.

[T1, T2, R1, R4][No. of Hrs. 12]

UNIT-IV

Grid Connectivity: wind power interconnection requirement - low-voltage ride through (LVRT), ramp-rate limitations, supply of ancillary services for frequency and voltage control, load following, reserve requirement, impact of connection on steady-state and dynamic performance of power system; interfacing dispersed generation of solar energy with the grid, protective relaying, islanding, voltage flicker and other power quality issues; role of non-conventional energy system in smart grid.

[T1, T2, R1, R2, R3, R4][No. of Hrs. 11]

Text Book(s):

- [T1] Tiwari and Ghosal, “Renewable Energy Resources: Basic Principle & Application”, Narosa Publication
[T2] S.N. Bhadra, D. Kasta, “Wind Electrical Systems”, Oxford Publication, 2014

References Books:

- [R1] John Twidell, “Renewable Energy Sources”, Taylor and Francis.
[R2] Godfrey Boyle, “Renewable Energy: Power for a Sustainable Future”, Oxford University Press.
[R3] Ewald F. Fuchs, “Power Conversion of Renewable Energy Systems”, Springer.
[R4] B. H. Khan, “Non-Conventional Energy”, Tata McGraw Hill.
[R5] D. P. Kothari, “Wind Energy System and Applications” Narosa Publication, 2014

DUCT DESIGN AND AIR DISTRIBUTION**Paper Code: ETVRA-752**

L	T/P	C
0	3	3

Paper: Duct Design and Air Distribution

Note:- The required list of Experiments is provided as under. The example cited here are purely indicative and not exhaustive. Attempt shall be made to perform all experiments. However, at least 8 experiments should be done in the semester. More experiments may be designed by the respective institutes as per their choice.

List of Experiments:

1. Study of duct designing in a building
2. Site visit to have knowledge of duct sheet measurement and cutting
3. Site visit to have knowledge of duct manufacturing and joints
4. Site visit to have knowledge of different types of duct fittings
5. Site visit to have knowledge of duct installations
6. Study of different types of outlet and air dampers
7. Design a ducting system for any building and select a blower for the same



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MATLAB

Paper Code: ETVRA-754
Paper: MATLAB

L	T/P	C
0	3	3

Note:- The required list of Experiments is provided as under. The example cited here are purely indicative and not exhaustive. Attempt shall be made to perform all experiments. However, at least 8 experiments should be done in the semester. More experiments may be designed by the respective institutes as per their choice.

List of Experiments:

1. Students have to perform at least six applications based on MAT LAB software.



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