
# III YEAR V SEMESTER BSc MPCs SYLLABUS

SRI RAMAKRISHNA DEGREE COLLEGE (AUTONOMOUS)

NANDYAL

SRI RAMAKRISHNA DEGREE COLLEGE(A) NDL
Semester-wise Revised Syllabus under CBCS, 2020-21

Domain Subject: **MATHEMATICS**
III Year B.A./B.Sc.– Semester – V
Max Marks: 100

**Course-6B: Multiple integrals and applications of Vector calculus**
(Skill Enhancement Course (Elective), 5 credits)

## I. Learning Outcomes:

Students after successful completion of the course will be able to

1. Learn multiple integrals as a natural extension of definite integral to a function of two variables in the case of double integral / three variables in the case of triple integral.
2. Learn applications in terms of finding surface area by double integral and volume by triple integral.
3. Determine the gradient, divergence and curl of a vector and vector identities.
4. Evaluate line, surface and volume integrals.
5. understand relation between surface and volume integrals (Gauss divergence theorem), relation between line integral and volume integral (Green's theorem), relation between line and surface integral (Stokes theorem)

**II. Syllabus:** (Hours: Teaching: 75 (incl. unit tests etc.05), Training: 15)

**Unit – 1: Multiple integrals-I** (15h)

1. Introduction, Double integrals, Evaluation of double integrals, Properties of double integrals.
2. Region of integration, double integration in Polar Co-ordinates,
3. Change of variables in double integrals, change of order of integration.

**Unit – 2: Multiple integrals-II** (15h)

1. Triple integral, region of integration, change of variables.
2. Plane areas by double integrals, surface area by double integral.
3. Volume as a double integral, volume as a triple integral.

**Unit – 3: Vector differentiation** (15h)

1. Vector differentiation, ordinaryderivatives of vectors.
2. Differentiability, Gradient, Divergence, Curl operators,
3. Formulae involving the separators.

**Unit – 4: Vector integration** (15h)

1. Line Integrals with examples.
2. Surface Integral with examples.
3. Volume integral with examples.

**Unit – 5: Vector integration applications** (15h)

1. Gauss theorem and applications of Gauss theorem.
2. Green's theorem in plane and applications of Green's theorem.
3. Stokes's theorem and applications of Stokes theorem.

**III. Reference Books:**


1. Dr.M Anitha, Linear Algebra and Vector Calculus for Engineer, Spectrum University Press, SR Nagar, Hyderabad-500038, INDIA.
2. Dr.M.Babu Prasad, Dr.K.Krishna Rao, D.Srinivasulu, Y.AdiNarayana, Engineering Mathematics-II, Spectrum University Press, SR Nagar, Hyderabad-500038,INDIA.
3. V.Venkateswararao, N. Krishnamurthy, B.V.S.S.Sarma and S.Anjaneya Sastry, A text Book of B.Sc., Mathematics Volume-III, S. Chand & Company, Pvt. Ltd., Ram Nagar,NewDelhi-110055.
4. R.Gupta,Vector Calculus, Laxmi Publications.
5. P.C.Matthews, Vector Calculus, Springer Verlag publications.
6. Web resources suggested by the teacher and college librarian including reading material.


**IV. Co-Curricular Activities:**

**A) Mandatory:**

**1. For Teacher:** Teacher shall train students in the following skills for 15 hours, by taking Relevant outside data (Field/Web).

**1.** The methods of evaluating double integrals and triple integrals in the class room and train to evaluate These integrals of different functions over different regions.

**2.** Applications of line integral, surface integral and volume integral.

**3.** Applications of Gauss divergence theorem, Green'stheorem and Stokes'stheorem.

**2. For Student: Fieldwork/Project work** Each student individually shall undertake Fieldwork/Project work and submit a report not exceeding 10 pages in the given format on the work-done in the areas like the following**,** by choosing any one of the following aspects.

**1.** Going through the web sources like Open Educational Resources to find the values of double and triple integrals of specific functions in a given region and make conclusions. (or)

**2.** Going through the web sources like Open Educational Resources to evaluate line integral, surface integral and volume integral and apply Gauss divergence theorem, Green's theorem and Stokes theorem and make conclusions.

**3. Max. Marks for Fieldwork/Project work Report: 05.**

**4. Suggested Format for Fieldwork/Project work Report**: Title page, Student Details, Index page,
Stepwise work-done, Findings, Conclusions and Acknowledgements.

**4. Unit tests (IE).**

**b) Suggested Co-Curricular Activities**:

1. Assignments/collection of data, Seminar, Quiz, Group discussions/Debates
2. Visits to research organizations, Statistical Cells, Universities, ISI etc.

3. Invited lectures and presentations on related topics by experts in the specified are

**V. Suggested Question Paper Pattern:**

**Max.Marks:70** **Time:3 hrs**

**SECTION - B** (Total: 5 X 4=20Marks)

(Answer any **five questions**. Each answer carries **4 Marks)**

**(At least 1 question should be given from each Unit)**

| | |
|---|---|
| 1. | |
| 2. | |
| 3. | |
| 4. | |
| 5. | |
| 6. | |
| 7. | |
| 8. | |

**SECTION - C** (Total: 5 X 10 = 50 Marks)

(Answer ALL the questions. Each question carries **10 Marks)**

| | |
|---|---|
| 1. | (a) or (b) |
| 2. | (a) or (b) |
| 3. | (a) or (b) |
| 4. | (a) or (b) |
| 5. | (a) or (b) |

SRI RAMAKRISHNA DEGREE COLLEGE(A) NDL

Semester-wise Revised Syllabus under CBCS, 2020-21

Domain Subject: **MATHEMATICS**

III Year B.A./B.Sc.– Semester – V

Max Marks: 100

**Course-7B: Integral transforms with applications**

(Skill Enhancement Course (Elective), 5 credits)

## I. Learning Outcomes:

Students after successful completion of the course will be able to

1. Evaluate Laplace transforms of certain functions, find Laplace transforms of derivatives and of integrals.
2. Determine properties of Laplace transform which may be solved by application of special functions namely Dirac delta function, error function, Bessel function and periodic function.
3. Understand properties of inverse Laplace transforms, find inverse Laplace transforms of derivatives and of integrals.
4. Solve ordinary differential equations with constant/ variable coefficients by using Laplace transform method.
5. Comprehend the properties of Fourier transforms and solve problems related to finite Fourier transforms.

**II. Syllabus :**( Hours: Teaching: 75 (incl. unit tests etc.05), Training: 15)

**Unit – 1: Laplace transforms- I** (15h)

**1.** Definition of Laplace transform, linearity property-piecewise continuous function.

**2.** Existence of Laplace transform, functions of exponential order and of class A.

**3.** First shifting theorem, second shifting theorem and change of scale property.

**Unit – 2: Laplace transforms- II** (15h)

1. Laplace Transform of the derivatives, initial value theorem and final value theorem. Laplace transforms of integrals.
2. Laplace transform of $t^n$. f (t), division by t, evolution of integrals by Laplace transforms.
3. Laplace transform of some special functions-namely Dirac delta function, error function, Bessel function and Laplace transform of periodic function.

**Unit – 3: Inverse Laplace transforms-I** (15h)

**1.** Definition of Inverse Laplace transform, linear property, first shifting theorem, second shifting theorem, change of scale property.

2. Inverse Laplace Transforms by use of partial fractions**.**

**Unit – 4: Inverse Laplace transforms-II (15h)**

1. Inverse Laplace transforms of derivatives, inverse, Laplace transforms of integrals, multiplication by powers of 'p', division by 'p'.
2. Convolution, convolution theorem proof and applications. Heaviside Expansion formula and its applications.

**Unit – 5: Applications of Laplace transforms** (15h)

1. Solutions of differential equations with constants coefficients, solutions of differential equations with variable coefficients.
2. Applications of Laplace transforms to integral equations- Abel's integral equation

**III. Reference Books:**


**1.** Dr. S.Sreenadh, S.Ranganatham, Dr.M.V.S.S.N.Prasad, Dr. V.Ramesh Babu, Fourier series and Integral Transforms, S. Chand & Company, Pvt. Ltd., Ram Nagar, New Delhi-110055.

**2.** A.R. Vasistha, Dr. R.K. Gupta, Laplace Transforms, Krishna Prakashan Media Pvt. Ltd. Meerut.

**3.** M.D.Raisinghania, H.C. Saxsena , H.K. Dass, Integral Transforms, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.

**4.** Dr. J.K. Goyal, K.P. Gupta, Laplace and Fourier Transforms, Pragathi Prakashan, Meerut.

**5.** Shanthi Narayana , P.K. Mittal, A Course of Mathematical Analysis, S. Chand & Company Pvt.Ltd. Ram Nagar, New Delhi-110055.

**6.** Web resources suggested by the teacher and college librarian including reading material.


**IV. Co-Curricular Activities:**

**A) Mandatory:**

**1. For Teacher:** Teacher shall train students in the following skills for 15 hours, by taking Relevant outside data (Field/Web).

1. Demonstrate on sufficient conditions for the existence of the Laplace transform of a function.

2. Evaluation of Laplace transforms and methods of finding Laplace transforms.

3. Evaluations of Inverse Laplace transforms and methods of finding Inverse Laplace transforms.

4. Fourier transforms and solutions of integral equations.

**2. For Student: Fieldwork/Project work;** Each student individually shall undertake Fieldwork/Project work and submit a report not exceeding 10 pages in the given format on the work-done in the areas like the following**,** by choosing any one of the aspects.

1. Going through the web sources like Open Educational Resources on Applications of Laplace transforms and Inverse Laplace transforms to find solutions of ordinary differential equations with constant /variable coefficients and make conclusions. (or)
2. Going through the web sources like Open Educational Resources on Applications of convolution theorem to solve integral equations and make conclusions. (or)
3. Going through the web source like Open Educational Resources on Applications of Fourier transforms to solve integral equations and make conclusions.

**4. Max. Marks for Fieldwork/Project work Report: 05.**

4. **Suggested Format for Fieldwork/Project work Report**: Title page, Student Details, Index page,
Stepwise work-done, Findings, Conclusions and Acknowledgements.

**5. Unit tests (IE).**

**b) Suggested Co-Curricular Activities**:

1. Assignments/collection of data, Seminar, Quiz, Group discussions/Debates
2. Visits to research organizations, Statistical Cells, Universities, ISI etc.
3. Invited lectures and presentations on related topics by experts in the specified area.

**V. Suggested Question Paper Pattern:**

**Max.Marks:70** **Time:3 hrs**

**SECTION - A** (Total: 5 X 4=20Marks)

(Answer any **five questions**. Each answer carries **4 Marks)**

**(At least 1 question should be given from each Unit)**

| | |
|---|---|
| 1. | |
| 2. | |
| 3. | |
| 4. | |
| 5. | |
| 6. | |
| 7. | |
| 8. | |

**SECTION - B** (Total: 5 X 10 = 50 Marks)

(Answer ALL the questions. Each question carries **10 Marks)**

| | |
|---|---|
| 1. | (a) or (b) |
| 2. | (a) or (b) |
| 3. | (a) or (b) |
| 4. | (a) or (b) |
| 5. | (a) or (b) |

**A.P. STATE COUNCIL OF HIGHER EDUCATION**

Semester-wise Revised Syllabus under CBCS, 2020-21

Course Code:

Four-year B.Sc. (Hons)

Domain Subject: **PHYSICS**

IV Year B. Sc.(Hons) – Semester – V

Max Marks: 100+50

## Course 6B: LOW TEMPERATURE PHYSICS & REFRIGERATION

(Skill Enhancement Course (Elective), Credits: 05)

**I. Learning Outcomes:** Students after successful completion of the course will be able to

1. Identify various methods and techniques used to produce low temperatures in the Laboratory.
2. Acquire a critical knowledge on refrigeration and air conditioning.
3. Demonstrate skills of Refrigerators through hands on experience and learns about refrigeration components and their accessories.
4. Understand the classification, properties of refrigerants and their effects on environment.
5. Comprehend the applications of Low Temperature Physics and refrigeration.

**II. Syllabus:** *(Total Hours: 90 including Teaching, Lab, Field Training, Unit tests etc.)*

**UNIT-I PRODUCTION OF LOW TEMPERATURE** (10 hrs)

Production of low temperatures-Introduction, Freezing mixtures, Joule-Thomson effect, Regenerative cooling, Different methods of liquefaction of gases, liquefaction of air, Production of liquid hydrogen and nitrogen, Adiabatic demagnetization, Properties of materials at low temperatures, Superconductivity

**UNIT-II MEASUREMENT OF LOW TEMPERATURE** (10 hrs)

Gas thermometer and its correction and calibration, Secondary thermometers, resistance thermometers, thermocouples, Vapour pressure thermometers, Magnetic thermometers, Advantages and drawbacks of each type of thermometer.

**UNIT-III PRINCIPLES OF REFRIGERATION** (10 hrs)

Introduction to Refrigeration- Natural and artificial refrigeration , Stages of refrigeration, Types of refrigeration - Vapor compression and vapor absorption refrigeration systems, Refrigeration cycle and explanation with a block diagram, Introductory ideas on air-conditioning.

Refrigerants-Introduction, Ideal refrigerant, Properties of refrigerant, Classification of refrigerants, commonly used refrigerants, Eco-friendly refrigerants

**UNIT-IV COMPONENTS OF REFIGERATOR** (10 hrs)

Refrigerator and its working, Block diagram, Coefficient of Performance (COP), Tons of refrigeration (TR) and Energy Efficiency Ratio (EER), Refrigerator components: Types of compressors, evaporators and condensers and their functional aspects, defrosting in a refrigerator, Refrigerant leakage and detection

**UNIT-V APPLICATIONS OF LOW TEMPERATURE & REFRIGERATION** (10 hrs.)

*Applications of Low temperatures*: Preservation of biological material, Food freezing, liquid nitrogen and liquid hydrogen in medical field, Superconducting magnets in MRI- Tissue ablation (cryosurgery) - Cryogenic rocket propulsion system.

*Applications of refrigeration*: Domestic refrigerators, Water coolers, Cold storages, Ice plants, Food preservation methods, Chemical and Process industries, Cold treatment of metals, Construction field, Desalination of water, Data centers.

**III. References:**


1. Heat and Thermodynamics by Brij Lal &N.Subramanyam, S.Chand Publishers.
2. Thermal Physics by S C Garg, R M Bansal & C K Ghosh, McGrawHill Education, India
3. Heat and Thermodynamics by M MZemansky,McGrawHill Education (India).
4. Low-Temperature Physics by Christian E. & Siegfried H., Springer.
5. Thermal Engineering by S. Singh, S.Pati, Ch:18 Introduction to Refrigeration.
6. The Physics Hyper Text Book. Refrigerators.https://physics.info/refrigerators/
7. Refrigeration and Air Conditioning by Manohar Prasad, New age international (P) limited, New Delhi
8. A course in Refrigeration and Air Conditioning by S.C. Arora and S. Domkundwar, Dhanpatrai and sons, Delhi

9.https://trc.nist.gov/cryogenics/Papers/Review/2017-Low_Temperature_Applications_and_Challenges.pdf

10. https://nptel.ac.in/content/storage2/courses/112105129/pdf/RAC%20Lecture%203.pdf

11. Other Web sources suggested by the teacher concerned and the reading material.

https://nptel.ac.in


## Course 6B: Low Temperature Physics & Refrigeration

**PRACTICAL SYLLABUS** *(30 Hrs. Max Marks: 50)*

**IV. Learning Outcomes:** On completion of practical course, student shall be able to

1. List out, identify and handle equipment used in refrigeration and low temperature lab.
2. Learn the procedures of preparation of Freezing Mixtures.
3. Demonstrate skills on developing various Freezing mixtures and materials and their applications in agriculture, medicine and day to day life.
4. Acquire skills in observing and measuring various methodologies of very low temperatures
5. Perform some techniques related to Refrigeration and Freezing in daily life.

**V. Practical (Laboratory) Syllabus**: *(30 hrs. Max marks: 50)*)

1. Record the Principles and applications of Refrigerators and Freezers.
2. Measure the temperatures below Melting point of Ice using a thermometer available in the Lab.
3. Make a freezing mixture by adding different salts viz., Sodium chloride, Potassium Hydrate (KOH), Calcium chloride to ice in different proportions and observe the temperature changes.
4. Study the operation of a refrigerator and understand the working of different parts.
5. Study the properties of refrigerants like chlorofluorocarbons-hydrochlorofluoro- carbons and record the lowest temperatures obtained.
6. Consider a simple faulty refrigerator and try to troubleshoot the simple problems by understanding its working.

7. Understand the practical problem of filling the Freon Gas into the Refrigerator.
8. Get the Liquid Nitrogen or Liquid Helium from nearby Veterinary Hospital and measure their temperatures using chromel-alumel thermocouple or mercury thermometer and observe their physical properties like colour, smell etc and precautions to be taken for their safe handling.
9. Preparation of freeze drying food with Dry ice and liquid nitrogen
10. Preparation of freeze drying food with liquid nitrogen

## VI. Lab References:


1. Experimental techniques in low temperature physics by Guy White, PhilipMeeson.
2. Experimental low-temperature physics by A. Kent, Macmillan physical science series
3. Physics and Chemistry at Low Temperatures by Leonid Khriachtchev.
https://www.routledge.com/Physics-and-Chemistry-at-Low-Temperatures
/Khriachtchev/p/book/9789814267519
4. Practical Cryogenics .http://research .physics illinois.edu /bezryadin /links/
practical%20Cryogenics.pdf
5. Freeze-Drying, 3rd Edition by Peter Haseley, Georg-Wilhelm Oetjen, Wiley (e-Book)
6. Web sources suggested by the teacher concerned.


## VII. Co-Curricular Activities:

**(a) Mandatory:**(*Training of students by teacher in field related skills: (lab:10 + field: 05*)

1. **For Teacher**: Training of students by the teacher in the in the laboratory/field for a total of not less than 15 hours on the techniques/skills of Low Temperature Production, methods used and applications of Low temperatures and refrigeration in day to day life and other applications in medicine and industry.
2. **For Student**: Student shall (individually) visit (i) a small ice plant or a cold storage plant (ii) Air Conditioner (AC) repair shop or (iii) Refrigerator repair shop to understand the construction, working principle and the trouble shooting of these devices after interacting with the technicians. **Or** Student shall observe the various thermodynamic processes taking place while working with the refrigerator and observe the leak detection in refrigeration system by different methods, air removal and charging of a refrigeration unit and testing of a refrigeration system to find out the Refrigerating capacity/Ton of refrigeration (TR) and the Power input. **Or** Student shall identify the refrigerant cylinder by color coding and standing pressure. **Or** Student shall visit the freezer aisle of a supermarket and observes the bags of different frozen fruits. Student shall write the observations and submit a hand-written Fieldwork/Project work not exceeding 10 pages in the given format to the teacher.

3. Max marks for Fieldwork/Project work: 05.
4. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations, findings and acknowledgements*.
5. Unit tests (IE).

**(b) Suggested Co-Curricular Activities**

1. Training of students by related Factory, industrial experts.
2. Assignments (including technical assignments like identifying tools in Refrigerators, Freezers and their handling, operational techniques with safety and security )
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques in Low Temperatures and applications.
5. Collection of material/figures/photos related to substances used in Freezing Mixtures, their Properties and availability etc., writing and organizing them in a systematic way in a file.
6. Visits to Ice plants and labs in universities, research organizations, private firms, etc.
7. Making your own mini refrigerator at home
8. Build your own water cooler with the materials available at home.
9. Making hand launched liquid nitrogen rockets
10. Experiments with Liquid nitrogen and strawberry/ banana/ lemon/ onion/ mushroom/ egg etc. (*To be tried under professional supervision only*).
11. Invited lectures and presentations on related topics by field/industrial experts
12. Identification of different Ozone-depleting substances (ODS) that damage the ozone layer in the upper atmosphere.
13. Demonstration to illustrate the greenhouse effect and the role of carbon dioxide as a greenhouse gas using plastic water bottles, flood light lamp, beakers and temperature sensors and observe the temperature changes.

    https://edu.rsc.org/experiments/modelling-the-greenhouse-effect/1543.article
    https://sealevel.jpl.nasa.gov/files/archive/activities/ts1hiac1.pdf

***

**A.P. STATE COUNCIL OF HIGHER EDUCATION**

Semester-wise Revised Syllabus under CBCS, 2020-21

Course Code**:**

Four-year B.Sc. (Hons)

Domain Subject**: Physics**

IV Year B. Sc.(Hons) – Semester – V

Max Marks: 100+50

**Course 7B: Solar Energy and Applications**

[Skill Enhancement Course (Elective), Credits: 05]

**I. Learning Outcomes:** After successful completion of the course, the student will be able to:

1. Understand Sun structure, forms of energy coming from the Sun and its measurement.
2. Acquire a critical knowledge on the working of thermal and photovoltaic collectors.
3. Demonstrate skills related to callus culture through hands on experience
4. Understand testing procedures and fault analysis of thermal collectors and PV modules.
5. Comprehend applications of thermal collectors and PV modules.

**II. Syllabus:** *(Total Hours: 90 including Teaching, Lab, Field Training, Unit tests etc.)*

**Unit - I: BASIC CONCEPTS OF SOLAR ENERGY** (10hrs)

Spectral distribution of solar radiation, Solar constant , zenith angle and Air-Mass, standard time, local apparent time, equation of time, direct, diffuse and total radiations. Pyrheliometer - working principle, direct radiation measurement, Pyrometer-working Principle, diffuse radiation measurement, Distinction between the two meters.

**Unit - II: SOLAR THERMAL COLLECTORS** (10hrs)

Solar Thermal Collectors-Introduction, Types of Thermal collectors, Flat plate collector – liquid heating type, Energy balance equation and efficiency, Evacuated tube collector, collector overall heat loss coefficient, Definitions of collector efficiency factor, collector heat-removal factor and collector flow factor, Testing of flat-plate collector, solar water heating system, natural and forced circulation types.

Concentrating collectors, Solar cookers, Solar dryers, Solar desalinators.

**Unit - III: FUNDAMENTALS OF SOLAR CELLS** (10hrs)

Semiconductor interface, Types, homo junction, hetero junction and Schottky barrier, advantages and drawbacks, Photovoltaic cell, equivalent circuit, output parameters, conversion efficiency, quantum efficiency, Measurement of I-V characteristics, series and shunt resistance, their effect on efficiency, Effect of light intensity, inclination and temperature on efficiency

**Unit -IV: TYPES OF SOLARCELLS AND MODULES** (10 hrs)

Types of solar cells, Crystalline silicon solar cells, I-V characteristics, poly-Si cells, Amorphous silicon cells, Thin film solar cells-CdTe/CdS and CuInGaSe2/CdS cell configurations, structures, advantages and limitations, Multi junction cells – Double and triple junction cells. Module fabrication steps, Modules in series and parallel, Bypass and blocking diodes

**Unit – V: SOLAR PHOTOVOLTAIC SYSTEMS** (10hrs)

Energy storage in PV systems, Energy storage modes, electrochemical storage, Batteries, Primary and secondary, Solid-state battery, Molten solvent battery, lead acid battery and dry batteries, Mechanical storage – Flywheel, Electrical storage –Super capacitor

**III. References:**

1. Solar Energy Utilization by G. D. Rai, Khanna Publishers
2. Solar Energy- Fundamentals, design, modelling and applications by G.N. Tiwari, Narosa Publications, 2005.
3. Solar Energy-Principles of thermal energy collection & storage by S.P. Sukhatme, Tata Mc-Graw Hill Publishers, 1999.
4. Science and Technology of Photovoltaics, P. Jayarama Reddy, CRC Press (Taylor & Francis Group), Leiden &BS Publications, Hyderabad, 2009.
5. Solar Photovoltaics- Fundamentals, technologies and applications, Chetan Singh Solanki, PHI Learning Pvt. Ltd.,
6. Web sources suggested by the teacher concerned and the college librarian including reading material.
   (a) https://courses.edx.org/c4x/DelftX/ET.3034TU/asset/solar_energy_v1.1.pdf
   (b) https://www.sku.ac.ir/Datafiles/BookLibrary/45/John%20A.%20Duffie,%20William%20A.%20Beckman(auth.)-Solar%20Engineering%20of%20Thermal%20Processes,%20Fourth%20Edition%20(2013).pdf

**Course 6B: Solar Energy and Applications – Practical (lab) work** *(30 hrs, Max Marks:50)*

**IV. Learning Outcomes :**On successful completion of this practical course, student shall be able to:

1. List out and identify various components of solar thermal collectors and systems, solar photovoltaic modules and systems.
2. Learn the procedures for measurement of direct, global and diffuse solar radiation, I - V characteristics and efficiency analysis of solar cells and modules.
3. Demonstrate skills acquired in evaluating the performance of solar cell / module in connecting them appropriately to get required power output.
4. Acquire skills in identification and elimination of the damaged panels without affecting the output power in a module / array.
5. Perform procedures and techniques related to general maintenance of solar thermal and photovoltaic modules.

**V. Practical (Laboratory) Syllabus**: (**30 hrs**) (Max.50 Marks)

1. Measurement of direct radiation using pyrheliometer.
2. Measurement of global and diffuse radiation using pyranometer.
3. Evaluation of performance of a flat plate collector
4. Evaluation of solar cell / module efficiency by studying the I – V measurements.
5. Determination of series and shunt resistance of a solar cell / module.
6. Determination of efficiency of two solar cells / modules connected in series.
7. Determination of efficiency of two solar cells / modules connected in parallel.
8. Study the effect of input intensity on the performance of solar cell / module.
9. Study the influence of cell / module temperature on the efficiency.
10. Study the effect of cell / module inclination on the efficiency.

**VI. Lab References**:

1.Solar Photo voltaic- Alab training manual, C.S. Solanki et al., Foundation Books Publishers, 2012.
2. Laboratory Manual on Solar thermal experiments, HP Garg, TC Kandpal, Narosa Publishing House 2000.
3. Web sources suggested by the teacher concerned.
https://renewablelab.niu.edu/experiments/solarPanel
Development of simple solar hot water collector:
https://www.youtube.com/watch?v=WP8H5IOTwYU
https://www.instructables.com/Solar-Water-Heater-From-Scratch/

**VII. Co-curricular Activities:**

**(a) Mandatory:** (*Training of students by teacher in field related skills: (lab:10 + field: 05*)

1. **For Teacher**: Training of students by the teacher in the in the laboratory/field for not less than 15 hours on the field techniques/skills related to measurement of direct, diffused and global solar radiation; demonstration of procedures used in the performance evaluation of solar flat plate collectors, solar photovoltaic cells and modules measurement of different parameters in the calculation of efficiency.

2. **For Student**: Students shall visit to solar thermal and photovoltaic laboratories in universities/research organizations/ nearby industries to observe and understand the techniques and procedures used for evaluation of solar collector, solar cell and module efficiencies. They shall write their observations and submit to the teacher hand-written Fieldwork/Project work not exceeding 10 pages in the given format.

3. Max marks for Fieldwork/Project work: 05.

4. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations, findings and acknowledgements*.

5. Unit tests (IE).

**(b) Suggested Co-Curricular Activities**

1. Training of students by related industrial/ technical experts using guest lectures/ invited talks.
2. Assignments (including technical assignments like identifying components of a solar hot water and solar photovoltaic systems and their handling, operational techniques and maintenance procedures with safety and security)
3. Seminars, Group discussions, Quiz, Debates etc. on related topics.
4. Preparation of videos on thermal and photovoltaic systems and technical procedures.
5. Collection of brochures/figures/photos related to products and applications of solar energy and organizing them in a systematic way in a file.
6. Making a (i) solar panel (ii) solar light (iii) solar cooker (iv) solar oven (v) solar inverter at Home.
7. Visits to nearby solar thermal system as well as solar photovoltaic power stations, firms, research organizations etc.

***

Semester-wise Revised Syllabus under CBCS, 2020-21
Four Year B.Sc.
Domain Subject: **ELECTRONICS**
IV Year B.Sc., - Semester – V

**Course 6A: Industrial Electronics**

(Skill Enhancement Course (Elective), 3+2 Credits)
Max. Marks: Theory:100 + Practical:50

**I. Learning Outcomes:** Students after successful completion of the course will be able to:

1. Identify various facilities required to set up a basic Instrumentation Laboratory.
2. Acquire a critical knowledge of various Electrical Instruments used in the Laboratory.
3. Demonstrate skills in using instruments like Rectifiers, Multimeters, Power supplies, Voltage Regulators etc. through hands-on experience.
4. Understand the Principle and operation of different Electronic Heating devices.

***II.* Syllabus:** *(Total Hours: 90 including Teaching, Lab, Field Training, Unit tests etc.)*

**Syllabus:**

**UNIT-I** (20 hours)
***Rectifiers and filters***: Rectifiers– Half wave, full-wave and bridge rectifiers- Efficiency- Ripple factor- Regulation – Harmonic components in rectified output – Types of filters- Choke input (inductor) filter- Shunt capacitor filter- L section and □ section filters.
***Voltage Regulators***: Transistor Series voltage regulator - Transistor Shunt voltage regulator – Three terminal regulators (78XX and 79XX).

**UNIT-II** (10 hours)
***Power Supplies***: Block diagram of regulated power supply – A simple regulated transistorized power supply (circuit and working) – Principle and working of switch mode power supply (SMPS).

**UNIT-III (10 hours)**
***Voltage Multipliers***: Half wave voltage doubler, Full wave voltage doubler, Voltage Tripler circuit diagram and working mentioning of applications of voltage multipliers.

**UNIT-IV** (10 hours)
***Controlled rectifiers***: SCR Half wave rectifier circuit, working with wave forms, mathematical analysis for resistive load - SCR Full wave rectifier circuit, working with wave forms, mathematical analysis for resistive load – SCR as inverter parallel and series circuits.

**UNIT-V** (10 hours)
***Heat effects:*** Resistance, inductance and dielectric heating. Principle of operations and its applications.

**Reference Books:**


1. Unified Electronics Volume II by J.P Agarwal and Amit Agarwal.
2. Industrial Electronics, S.B. Biswas, Dhanapur Rai & Sons.
3. Industrial Electronics, G.K. Mithal, Khanna Publishers.
4. Electronic Devices and Circuits – G.K. Mithal.
5. Electronic Devices and Circuits-Millman and Halkias- Tata Mc Graw Hill (TMH)
6. Microelectronics- J. Millman and A. Grabel - TMH

**ELECTRONICS: LAB – 6A**

**Industrial Electronics**

**(ANY SIX EXPERIMEMTS SHOULD BE DONE)**

1. D.C Power supply and filters.
2. Transistor series regulator
3. Transistor as a shunt regulator
4. Voltage regulator using IC-7805and IC-7905.
5. Voltage doubler using diodes
6. Voltage Tripler using diodes
7. SCR VI characteristics.
8. SCR Series inverter
9. SCR parallel inverter.

Verified by
BOS chairman
V. Sreetha
4/7/22

**Model Question Paper**

**PAPER - 6A : Industrial Electronics**
(w.e.f. 2022-23)

**Time: 3 hours** **Max. Marks: 75**

**Part A (5 X 5 = 25 Marks)**

**Answer any FIVE of the following:**

1.
2.
3.
4.
5.
6.
7.
8.
9.
10

**Part B (5x10=50 Marks)**

**Answer the following**

**11.**

**(OR)**

**12.**

**13.**

**(OR)**

**14.**

**15.**

**(OR)**

**16.**

**17.**

**(OR)**

**18.**

**19.**

**(OR)**

**20.**

Verified by
BOS chairman
V. Sreedhar

Semester-wise Revised Syllabus under CBCS, 2020-21
Domain Subject: **ELECTRONICS**
IV Year B.Sc. - Semester – V
**Course 7A: Electronic Instrumentation** (Skill Enhancement Course (Elective), 3+2 Credits) Max. Marks: Theory:100 + Practical:50

**I. Learning Outcomes:** Students after successful completion of the course will be able to:1.

1. Identify various facilities required to set up a basic Instrumentation Laboratory.
2. Acquire a critical knowledge of various Electrical Instruments used in the Laboratory.
3. Demonstrate skills of using instruments like CRO, Function Generator, Multimeter etc. through hands on experience.
4. Understand the Principle and operation of different display devices used in the display systems and different transducers
5. Comprehend the applications of various biomedical instruments in daily life like B.P. meter, ECG, Pulse oxymeter etc. and know the handling procedures with safety and security.

**II. Syllabus:** *(Total Hours: 90 including Teaching, Lab, Field Training, Unit tests etc.)*

**UNIT-I** ***Introduction To Instruments*** (10 hrs)

Types of electronic Instruments - Analog instruments & Digital Instruments, DC Voltmeter and AC Voltmeter, Construction and working of an Analog Multimeter and Digital Multimeter (Block diagram approach), Sensitivity, 3½display and 4½ display Digital multimeters, Basic ideas on Function generator.

**UNIT-II** ***Oscilloscope*** (10 hrs)

Cathode Ray Oscilloscope-Introduction, Block diagram of basic CRO, Cathode ray tube, Electron gun assembly, Screen for CRT, Time base operation, Vertical deflection system, Horizontal deflection system, Use of CRO for the measurement of voltage (AC and DC), frequency, phase difference, Different types of oscilloscopes and uses.

**UNIT-III** ***Transducers*** (10 hrs)

Classification of transducers, Selection of transducers, Resistive, capacitive & inductive transducers, Resistive and capacitive touch screen transducer used in mobiles, Displacement transducer-LVDT, Piezoelectric transducer, Photo transducer, Digital transducer, Fibre optic sensors

**UNIT-IV** ***Display Instruments*** (10 hrs)

Introduction to Display devices, Seven Segment Displays, LED Displays, Construction and operation (Display of numbers),Types of SSDs (Common Anode & Common Cathode type), Limitations of SSDs, Liquid Crystal Displays, Applications of LCD modules.

**UNIT-V** ***Biomedical Instruments*** (10 hrs)

Basic operating principles and uses of (i) Clinical thermometer (ii) Stethescope (iii) Sphygmomanometer (iv) ECG machine (v) Radiography (vi) Ophthalmoscope (vii) Ultrasound scanning (viii) Pulse oxymeter (ix) Glucometer, Basic ideas of CT scan and MRI scan.

**Reference Books:**


1. Electronic Instrumentation by H.S.Kalsi , TMH Publishers
2. Electronic Instrument Hand Book by Clyde F. Coombs , McGraw Hill
3. Introduction to Biomedical Instrumentation byMandeep Singh, PHI Learning.

4. Biomedical Instrumentation and Measurements by Leslie Cromwell ,Prentice Hall India.
5. Electronic Measurements and Instrumentation by Kishor, K Lal, Pearson, New Delhi
6. Electrical and Electronic Measurements by Sahan, A.K., Dhanpat Rai, New Delhi
7. Electronic Instruments and Measurement Techniques by Cooper, W.D. Halfrick, A.B., PHI Learning, New Delhi
8. Web sources suggested by the teacher concerned and the college librarian including reading material.

## Course 7A: Electronic Instrumentation– PRACTICAL SYLLABUS

*(30 Hrs. Max Marks: 50)*

**III. Learning Outcomes:** On successful completion of this practical course, student shall be able to:

1. List out, identify and handle various equipment in Instrumentation Laboratory or Electronic Laboratory.
2. Learn the construction, operational principles of various instruments.
3. Demonstrate skills in handling, Maintenance & troubleshooting of different instruments used in the Labs.
4. Acquire skills in observing and measuring various electrical and electronic quantities.
5. Perform some techniques related to Biomedical Instrumentation and measurement of Certain physiological parameters like body temperature, B.P. and sugar levels etc.

**IV. Practical (Laboratory) Syllabus**: *(30 hrs. Max marks: 50)*

1.. Familiarisation of digital multimeter and its usage in the measurements of (i) resistance, (ii) current, (iii) AC & DC voltages and for (i) continuity test (ii)diode test and (iii) transistor test.

2.Measure the AC and DC voltages, frequency using a CRO and compare the values Measured with other instruments like Digital Multimeter.

3. Formation of Sine, Square wave signals on the CRO using Function Generator and measure their frequencies. Compare the measured values with actual values.
4. Display the numbers from 0 to 9 on a single Seven Segment Display module by Applying voltages.
5. Display the letters **a** to **h** on a single Seven Segment Display module by applying voltages.
6. Measurement of body temperature using a digital thermometer and list out the error and corrections.
7. Measurement of Blood Pressure of a person using a B.P. meter And record the values and analyze them.
8. Get acquainted with an available ECG machine and study the ECG pattern to understand the meaning of various peaks

9. Observe and understand the operation of a Digital Pulse oxymeter and measure the pulse rate of different people and understand the working of the meter.

Lab References:


1. Electronic Measurement and Instrumentation by J.P. Navani. ,S Chand & Co Ltd
2. Principles of Electronic Instrumentation by A De Sa, Elsevier Science Publ.
3. Electronic Measurements and Instrumentation by S.P.Bihari, YogitaKumari, Dr. Vinay Kakka, Vayu Education of India.
4. Laboratory Manual For Introductory Electronics Experiments by Maheshwari, New Age
5. International (P) Ltd., Publishers.
6. Electricity-Electronics Fundamentals: A Text-lab Manual by Paul B. Zbar
7. ,Joseph Sloop, & Joseph G. Sloop, McGraw-Hill Education.
8. Web sources suggested by the teacher concerned.


**Co-Curricular Activities**

**(a) Mandatory:**(*Training of students by the teacher in field related skills: (lab:10 + field·05*)

1.**For Teacher**: Training of students by the teacher in the laboratory/field for not less than 15 hours on the field techniques/skills of understanding the operation, Maintenance and utility of various electrical and electronic instruments both in the Laboratory as well as in daily life.

**For Student**: Students shall (individually)visit a local electrical and electronics shop or small firm to familiarize themselves with the various electrical and electronic instruments available in the market and also to understand their functionality, principle of operation and applications as well as the troubleshooting of these instruments.(Or) The student shall visit a diagnostic centre and observe the ECG machine and the ECG pattern(Or) Student shall visit a diagnostic centre and observe the CT scan and MRI scan.(Or) Students shall visit a mobile smartphone repair shop and observe the different components on the PCB(Motherboard), different ICs (chips) used in the motherboard and troubleshooting of touch screens in smartphones.

Observations shall be recorded in a hand-written Fieldwork/Project work not exceeding 10 pages in the given format to be submitted to the teacher.

2. Max marks for Fieldwork/Project work: 05.

3.Suggested Format for Fieldwork/Project work: *Title page, student details, index, page, details of a place visited, observations, findings and acknowledgments*.

4.Unit tests (IE)

**Suggested Co-Curricular Activities**

1. Training of students by related industrial/technical experts.
2. Assignments (including technical assignments like identifying different measuring instruments and tools and their handling, operational techniques with safety and security.
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Make your own stethoscope at home.
5. Making a seven-segment display at home.
6. Preparation of videos on tools and techniques in various branches of instrumentation.

7. Collection of material/figures/photos related to products of Measuring Instruments, Display Modules and Biomedical Instruments and arrange them in a systematic way in a file.

8. Visits to Instrumentation Laboratories of local Universities or Industries like Cement, Chemical or Sugar Plants etc. or any nearby research organizations, private firms, etc.

9. Invited lectures and presentations on related topics by Technical /industrial experts

***

Verified by
Bos chairmen
V. Sreedhar