# MGM University

# Chhatrapati Sambhajinagar

**Name of Faculty –** **Engineering & Technology**

**Name of College –** **University Department of Instrumentation and Control Engineering**

**Name of Department –** **Instrumentation and Control Engineering (ICE)**

**Name of Programme –** **B.Tech. Instrumentation and Control Engineering**

## CURRICULUM BOOKLET

**(**According to NEP 2020 with effect from Academic year 2025-26**)**

# MGM University

## Chhatrapati Sambhajinagar



Published by –

**Academic Section,**
**Registrar Office,**
**MGM University.**

# Contents

# MGM University

# Chhatrapati Sambhajinagar

## Vision

- To ensure sustainable human development which encourages a self- reliant and self-content society.
- To promote activities related to community services, social welfare, and also Indian heritage and culture.
- To inculcate the culture of non-violence and truthfulness through 'Vipassana', meditation, and Gandhian Philosophy.
- To develop the culture of 'simple living and high thinking.

## Mission

- To establish a centre of excellence for modern education, research, innovation, and all-round development of students
- Inculcate scientific temperament, inquiring abilities and inquisitive attitude.
- Emphasis on interdisciplinary education and programme.
- Creating unwavering sensitivity to ethics, morality and healthy practices in professional and personal life.
- Providing education in the disciplines related to Indian art and rich heritage thereby preserving our ancient knowledge and wisdom.
- Infuse a culture of interdisciplinary education for a broader understanding and enrichment of life.
- Creating an environment where empathy, service to society and societal concern become a second nature.
- Empower students to fit into the world of 'new economic order' and help India attain 'pride of place' at the global level.

# विद्यापीठ गीत

अत्त दिप भव भव प्रदिप भव,

स्वरूप रूप भव हो

ज्ञान सब्ब विज्ञान सब्ब भव,

सब्ब दिप भव हो

अत्ताहि अत्त नो नाथो,

अत्ताहि अत्त नो गति

अत्त मार्गपरअप्रमादसे है तुझे चलना

सब्ब का कल्याण हो,

वो कार्यकुशल करना



सब्ब का उत्तम मंगल,

पथ प्रदर्शक हो

अत्त दिप भव भव प्रदिप भव,

स्वरूप रूप भव हो

ज्ञान सब्ब विज्ञान सब्ब भव,

सब्ब दिप भव हो

बुद्धमं शरनं गच्छामि :

धम्मं शरनं गच्छामि :

संघं शरनं गच्छामि :

# University Department of Instrumentation and Control Engineering at a Glance

UDICE is an learning initiative taken up to develop and groom Instrumentation & Control Engineers in the Industrial Automation, System Integration & Designing, Project Management, erection and Commissioning of the projects, operations, trouble shooting, Research & Analysis for the process Industries, space research, Calibration &Testing, Automotive, Robotics with the blend of specialized knowledge with the wings of latest technologies like Artificial intelligence, Machine Learning, Data Analytics, Internet of the Things etc.

It also provide legitimate emphasis on Biomedical Instrumentation, Control system, Sensors & Transducers, Agro & analytical Instrumentation.

The program offered by UDICE, B.Tech Instrumentation & Control is the four year degree course designed according the guidelines of UGC, AICTE and aligned with NEP. The degree options in the program are possible as:

- B.Tech Instrumentation & Control Engineering with Multidisciplinary minor (Opted MDM Title)
- B.Tech (Honors)Instrumentation & Control Engineering with Multidisciplinary minor (Opted MDM Title)
- B.Tech (Honors with Research) Instrumentation & Control Engineering with Multidisciplinary minor (Opted MDM Title)
- B.Tech Instrumentation & Control Engineering with Double Minors (Multidisciplinary minor Opted MDM Title)

This curriculum design enables the students for developing themselves for global competitiveness and employability with human values.

# University Department of Instrumentation and Control Engineering

## Vision

- To ensure sustainable human development which encourages self-reliant and self-content society.
- To promote activities related to Industry Utility, community services, social welfare and also Indian heritage and culture.
- To inculcate the culture of non-violence and truthfulness through vipassanna meditation and Gandhian Philosophy.
- To develop the culture of Research, Innovation And Analysis

## Mission



- To impart state of art education and technical expertise to students and give necessary training to teachers to create self-reliant society for future.
- To encourage students to participate in Indian and International activities in Technology, Engineering Explorations, sports, literature, etc. So that future generation becomes base for free and liberal society
- To educate students not only in the Technology But in areas like Management, Finance, Human relations to inculcate philosophy of simple living and high thinking value of simple economic society also.
- To inculcate culture of non-violence and truthfulness through Vipassana.

# University Department of Instrumentation and Control Engineering

**Name of Program –** B.Tech Instrumentation and Control Engineering

**Duration –** Four Years Degree course (Conducted by MGM University, as per the Guidelines of AICTE and Aligned with NEP-2020

**Eligibility –**

## 1. Maharashtra State Candidate.

(i) The Candidate should be an Indian National and having domicile of Maharashtra state and/or born in Maharashtra state.

(ii) Passed HSC or its equivalent examination with Physics and Mathematics as compulsory subjects along with one of the Chemistry or Biotechnology or Biology or Technical Vocational subject or Computer Science or Information Technology or Informatics Practices or Agriculture or Engineering Graphics or Business Studies, and obtained at least 45% marks (at least 40% marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only) in the above subjects taken together and the candidate should have appeared in MGMU-CET 2022/ MHT-CET 2022/ PERA CET 2022/ JEE (Main) Paper-I 2022 and should obtain non zero score in MGMU-CET 2022/ MHT-CET 2022/ PERA CET 2022/ JEE (Main) Paper-I 2022. However, preference shall be given to the candidate obtaining non-zero positive score in MGMU-CET 2022 over the candidates who obtained non-zero score in MHT-CET 2022/ PERA CET 2022.

**OR**

(ii)Passed Diploma in Engineering and Technology and obtained at least 45% marks (at least 40% marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only).

## 2. All India Candidates –

(i) The Candidate should be an Indian National.

(ii) Passed HSC or its equivalent examination with Physics and Mathematics as compulsory subjects along with one of the Chemistry or Biotechnology or Biology or Technical Vocational subject or Computer Science or Information Technology or Informatics Practices or Agriculture or Engineering Graphics or Business Studies , and obtained at least 45% marks (at least 40% marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only) in the above subjects taken together and candidate should have appeared in MGMU-CET 2022/ MHT-CET 2022/ PERA CET 2022/ JEE (Main) Paper-I 2022 and should obtain non-zero score in MGMU-CET 2022/ MHT-CET 2022/ PERA CET 2022/ JEE (Main) Paper-I 2022. However, preference shall be given to the candidate obtaining non-zero positive score in JEE Mains Paper-I over the candidates who obtained non-zero score in MGMU-CET 2022/ MHT-CET 2022/ PERA CET 2022.

**OR**

(ii) Passed Diploma in Engineering and Technology and obtained at least 45% marks (at least 40% marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only)

# MGM University, Chhatrapati Sambhajinagar
## Faculty of Engineering and Technology

**Name of Faculty**: Faculty of Engineering and Technology
**Name of the College/Institute/Department/School:** University Department of Instrumentation and Control Engineering, Chhatrapati Sambhajinagar.
**Name of the Programme:** B. Tech. Instrumentation and Control Engineering, with Multidisciplinary Minor
**Programme Type:** UG
**Duration:** 4 Years

| First Year - Semester I (Group A) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Category** | **Course Code** | **Course Title** | **Nature of Course** | **No of Credits** | **Teaching (Contact hrs/ week)** | | **Evaluation Scheme (Marks)** | | | **Minimum Passing (Marks)** | | |
| | | | | | **L** | **P** | **Internal** | **External** | **Total** | **Internal** | **External** | **Total** |
| BSC | APS21BSL101 | Single And Multivariable Calculus | Lecture | 4 | 4 | - | 60 | 40 | 100 | - | 16 | 40 |
| BSC | APS21BSL102 | Engineering Physics | Lecture | 3 | 3 | - | 60 | 40 | 100 | - | 16 | 40 |
| ESC | APS21ESL101 | Python Programming | Lecture | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| ESC | APS21ESL102 | Engineering Graphics | Lecture | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| AEC | MGM54AEL101 | Communicative English | Lecture | 1 | 1 | - | 30 | 20 | 50 | - | 8 | 20 |
| VSEC | APS21VSP101 | Engineering Exploration | Practical | 2 | - | 4 | 60 | 40 | 100 | - | 16 | 40 |
| BSC | APS21BSP101 | Engineering Physics Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| ESC | APS21ESP101 | Python Programming Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| ESC | APS21ESP102 | Engineering Graphics Studio | Practical | 2 | - | 4 | 30 | 20 | 50 | - | 8 | 20 |
| ESC | APS21ESP103 | Recent Trends In Integrated Technology | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| AEC | MGM54AEP101 | Communicative English Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| CCA | MGM82CCP101 MGM82CCP102 MGM82CCP103 | Ncc / Yoga / Sports | Practical | 2 | - | 4 | 30 | 20 | 50 | - | 8 | 20 |
| | | | **TOTAL** | **22** | **12** | **20** | **510** | **340** | **850** | | | |

| First Year - Semester II (Group A) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Category** | **Course Code** | **Course Title** | **Nature of Course** | **No of Credits** | **Teaching (Contact hrs/ week)** | | **Evaluation Scheme (Marks)** | | | **Minimum Passing (Marks)** | | |
| | | | | | **L** | **P** | **Internal** | **External** | **Total** | **Internal** | **External** | **Total** |
| BSC | APS21BSL103 | Linear Algebra And Differential Equations | Theory | 4 | 4 | - | 60 | 40 | 100 | - | 16 | 40 |
| BSC | APS21BSL104 | Engineering Chemistry | Theory | 3 | 3 | - | 60 | 40 | 100 | - | 16 | 40 |
| ESC | APS21ESL103 | Engineering Mechanics | Theory | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| ESC | APS21ESL104 | Building Programming Logic In C | Theory | 1 | 1 | - | 30 | 20 | 50 | - | 8 | 20 |
| PCC | APS21PCL101 | Basics Of Electrical And Electronics Engineering | Theory | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| IKS | APS21IKL1XX | Indian Knowledge System | Theory | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| VSEC | APS21VSP102 | Workshop Practices | Practical | 2 | - | 4 | 60 | 40 | 100 | - | 16 | 40 |
| BSC | APS21BSP102 | Engineering Chemistry Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| ESC | APS21ESP104 | Engineering Mechanics Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| ESC | APS21ESP105 | Building Programming Logic In C Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| PCC | APS21PCP101 | Electrical And Electronics Technology Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| CCA | MGM82CCP104<br>MGM73CCP105<br>MGM73CCP106 | NSS/<br>Fine Art/<br>Visual Art | Practical | 2 | - | 4 | 30 | 20 | 50 | - | 8 | 20 |
| | | | **TOTAL** | **22** | **14** | **16** | **540** | **360** | **900** | | | |

| First Year - Semester I (Group B) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Category** | **Course Code** | **Course Title** | **Nature of Course** | **No of Credits** | **Teaching (Contact hrs/ week)** | | **Evaluation Scheme (Marks)** | | | **Minimum Passing (Marks)** | | |
| | | | | | **L** | **P** | **Internal** | **External** | **Total** | **Internal** | **External** | **Total** |
| BSC | APS21BSL101 | Single And Multivariable Calculus | Theory | 4 | 4 | - | 60 | 40 | 100 | - | 16 | 40 |
| BSC | APS21BSL104 | Engineering Chemistry | Theory | 3 | 3 | - | 60 | 40 | 100 | - | 16 | 40 |
| ESC | APS21ESL101 | Python Programming | Theory | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| ESC | APS21ESL103 | Engineering Mechanics | Theory | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| AEC | MGM54AEL101 | Communicative English | Theory | 1 | 1 | - | 30 | 20 | 50 | - | 8 | 20 |
| PCC | APS21PCL101 | Basics Of Electrical And Electronics Engineering | Theory | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| VSEC | APS21VSP102 | Workshop Practices | Practical | 2 | - | 4 | 60 | 40 | 100 | - | 16 | 40 |
| BSC | APS21BSP102 | Engineering Chemistry Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| ESC | APS21ESP101 | Python Programming Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| ESC | APS21ESP104 | Engineering Mechanics Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| AEC | MGM54AEP101 | Communicative English Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| PCC | APS21PCP101 | Electrical And Electronics Technology Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| CCA | MGM82CCP101 MGM82CCP102 MGM82CCP103 | NCC/ Yoga / Sports | Practical | 2 | - | 4 | 30 | 20 | 50 | - | 8 | 20 |
| | | | **TOTAL** | **23** | **14** | **18** | **570** | **380** | **950** | | | |

| First Year - Semester II (Group B) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Nature of Course | No of Credits | Teaching (Contact hrs/ week) | | Evaluation Scheme (Marks) | | | Minimum Passing (Marks) | | |
| | | | | | L | P | Internal | External | Total | Internal | External | Total |
| BSC | APS21BSL103 | Linear Algebra And Differential Equations | Theory | 4 | 4 | - | 60 | 40 | 100 | - | 16 | 40 |
| BSC | APS21BSL102 | Engineering Physics | Theory | 3 | 3 | - | 60 | 40 | 100 | - | 16 | 40 |
| ESC | APS21ESL102 | Engineering Graphics | Theory | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| IKS | APS21IKL1XX | Indian Knowledge System | Theory | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| ESC | APS21ESL104 | Building Programming Logic In C | Theory | 1 | 1 | - | 30 | 20 | 50 | - | 8 | 20 |
| VSEC | APS21VSP101 | Engineering Exploration | Practical | 2 | - | 4 | 60 | 40 | 100 | - | 16 | 40 |
| BSC | APS21BSP101 | Engineering Physics Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| ESC | APS21ESP102 | Engineering Graphics Studio | Practical | 2 | - | 4 | 30 | 20 | 50 | - | 8 | 20 |
| ESC | APS21ESP105 | Building Programming Logic In C Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| ESC | APS21ESP103 | Recent Trends In Integrated Technology | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| CCA | MGM82CCP104 MGM73CCP105 MGM73CCP106 | NSS/ Fine Art/ Visual Art | Practical | 2 | - | 4 | 30 | 20 | 50 | - | 8 | 20 |
| | | | **TOTAL** | **21** | **12** | **18** | **480** | **320** | **800** | | | |

Exit option to qualify for Certification, common at Institute level: After securing all credits of First Year and securing 8 credits in work-based vocational courses or internship / Apprenticeship offered during summer vacation will be awarded One Year UG certificate in Tech( Discipline) (As per Annexture- I).

**•Work-based vocational course 1: 04 credits (Elements of basic Electronics)**

**•Work-based vocational course 2: 04 credits (Digital Electronics)**

Students after FY can opt for B.Tech. Degree with Honors'/ Double Minor. Eligibility for admission will be minimum CGPA of 7.5 at First Year.

**For Honors**: The students will have to take additional 5 courses of 18 credits in Instrumentation and Control Engineering discipline distributed over semesters III to VIII. (As per Annexure II )

**For Double Minors** : The students will have to take additional 5 courses of 18 credits in another Technology discipline/Emerging areas specialization distributed over semesters III to VIII.( As per Annexure III )

| Semester III | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Category** | **Course Code** | **Course Title** | **Nature of Course** | **No of Credits** | **Teaching (Contact hrs/ week)** | | **Evaluation Scheme (Marks)** | | | **Minimum Passing (Marks)** | | |
| | | | | | **L** | **P** | **Internal** | **External** | **Total** | **Internal** | **External** | **Total** |
| PCC | BIC26PCL201 | Sensors & Transducers | Lecture | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| PCC | BIC26PCL 202 | Control System | Lecture | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| PCC | BIC26PCL203 | Electrical Machines | Lecture | 3 | 3 | - | 60 | 40 | 100 | - | 16 | 40 |
| PCC | BIC26PCP201 | Sensors & Transducers Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| PCC | BIC26PCP202 | Control System Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| PCC | BIC26PCP203 | Electrical Machines Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| MDM | MDM | Refer Mgmu Mdm Basket (Annexure -A) | Lecture | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| OE | OE-1 | Refer MGMU Basket Of Open Elective | Lecture | 2 | 2 | | 30 | 20 | 50 | | 8 | 20 |
| OE | OE-2 | Refer MGMU Basket Of Open Elective | Lecture | 2 | 2 | | 30 | 20 | 50 | | 8 | 20 |
| EEMC | BIC26HSL204 | Business Management & Financial Accounting | Lecture | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| VEC | MGM56VEL102 | Constitution Of India | Lecture | 2 | 2 | - | 30 | 20 | 50 | - | 8 | 20 |
| CEP/FP | BIC26CEP205 | Field Project | Practical | 2 | - | 4 | 50 | - | 50 | 20 | - | 20 |
| **TOTAL** | | | | **22** | **17** | **10** | **530** | **320** | **850** | | | |

PCC: Program core course,

PEC: Program Elective Course,

MDM: Multidisciplinary minor,

OE: Open Elective,

RM: Research Methodology,

VSEC: Vocational and skill Enhancement Course,

EEMC: Entrepreneurship/Economics/Management Course,

VEC: Value Education course

AEC: Ability Enhancement Course.

| Semester-IV | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Category** | **Course Code** | **Course Title** | **Nature of Course** | **No of Credits** | **Teaching (Contact hrs/ week)** | | **Evaluation Scheme (Marks)** | | | **Minimum Passing (Marks)** | | |
| | | | | | **L** | **P** | **Internal** | **External** | **Total** | **Internal** | **External** | **Total** |
| PCC | BIC26PCL 251 | Industrial Process Operations | Lecture | 3 | 3 | | 60 | 40 | 100 | - | 16 | 40 |
| PCC | BIC26PCL252 | Process Control | Lecture | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| PCC | BIC26PCL253 | Microcontroller And Embedded System | Lecture | 3 | 3 | - | 60 | 40 | 100 | - | 16 | 40 |
| PCC | BIC26PCP252 | Process Control Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| PCC | BIC26PCP253 | Microcontroller And Embedded System Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| MDM | MDM | Refer Mgmu Mdm Basket (Annexure -A) | Lecture | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| OE | OE-3 | Refer MGMU Basket Of Open Elective | Lecture | 2 | 2 | - | 30 | 20 | 50 | - | 8 | 20 |
| VSEC | BIC26VSP254 | Industry 4.0 Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | | 8 | 20 |
| VSEC | BIC26VSP255 | Industrial Safety | Practical | 1 | | 2 | 30 | 20 | 50 | | 8 | 20 |
| EEMC | BIC26HSL256 | Entrepreneurship Development | Lecture | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| VEC | MGM21VEL101 | Environmental Studies | Lecture | 2 | 2 | - | 30 | 20 | 50 | - | 8 | 20 |
| AEC | AEC | Refer MGMU Basket Of AEC | Lecture | 2 | 2 | - | 30 | 20 | 50 | - | 8 | 20 |
| **TOTAL** | | | | **22** | **18** | **8** | **510** | **340** | **850** | | | |

Exit option to qualify for UG Diploma in Instrumentation and Control Engineering: After securing all credits of first and second year and provided the student secures additional 8 credits in skill-based vocational courses (skill-based courses, internship, mini projects etc.) offered using summer vacation after the first year or second year. (As per Annexure - I)

• **Skill-based vocational course 1: 04 (MATLAB) Skill-based vocational course 2: 04 credits (Excel Programming)**

| Semester V | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Category** | **Course Code** | **Course Title** | **Nature of Course** | **No of Credits** | **Teaching (Contact hrs/ week)** | | **Evaluation Scheme (Marks)** | | | **Minimum Passing (Marks)** | | |
| | | | | | **L** | **P** | **Internal** | **External** | **Total** | **Internal** | **External** | **Total** |
| PCC | BIC26PCL301 | Industrial Drives | Lecture | 3 | 3 | | 60 | 40 | 100 | - | 16 | 40 |
| PCC | BIC26PCL302 | PLC , DCS & Scada-1 | Lecture | 3 | 3 | - | 60 | 40 | 100 | - | 16 | 40 |
| PCC | BIC26PCL303 | Feedback Control Systems | Lecture | 3 | 3 | - | 60 | 40 | 100 | - | 16 | 40 |
| PCC | BIC26PCL304 | Instrumentation System Designing | Lecture | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| PCC | BIC26PCP301 | Industrial Drives Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| **Program Elective - I** | | | | | | | | | | | | |
| PEC | BIC26PEL305 | Building Management System | Lecture | 3 | 3 | - | 60 | 40 | 100 | - | 16 | 40 |
| PEC | BIC26PEL306 | Industrial Piping And Boiler Automation Design | | | | | | | | | | |
| PEC | BIC26PEL307 | Robotics And Applications | | | | | | | | | | |
| PEC | BIC26PEP305 | Building Management System Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| PEC | BIC26PEP306 | Industrial Piping & Boiler Automation Design Lab | | | | | | | | | | |
| PEC | BIC26PEP307 | EV And Battery Management System Lab | | | | | | | | | | |
| MDM | MDM | Refer MGMU MDM Basket(Annexure -A) | Lecture | 4 | 4 | - | 60 | 40 | 100 | - | 16 | 40 |
| OE | OE-4 | Refer MGMU Basket Of Open Elective | Lecture | 2 | 2 | - | 30 | 20 | 50 | - | 8 | 20 |
| **TOTAL** | | | | **22** | **20** | **4** | **450** | **300** | **750** | | | |

| Semester VI | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Category** | **Course Code** | **Course Title** | **Nature of Course** | **No of Credits** | **Teaching (Contact hrs/ week)** | | **Evaluation Scheme (Marks)** | | | **Minimum Passing (Marks)** | | |
| | | | | | **L** | **P** | **Internal** | **External** | **Total** | **Internal** | **External** | **Total** |
| PCC | BIC26PCL351 | Biomedical Instrumentation-I | Lecture | 3 | 3 | - | 60 | 40 | 100 | - | 16 | 40 |
| PCC | BIC26PCL352 | Internet Of Things | Lecture | 3 | 3 | | 60 | 40 | 100 | - | 16 | 40 |
| PCC | BIC26PCL353 | Computer Network | Lecture | 3 | 3 | - | 60 | 40 | 100 | - | 16 | 40 |
| PCC | BIC26PCP352 | Internet Of Things Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| PCC | BIC26PCP353 | Computer Network Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| **Program Elective - II** | | | | | | | | | | | | |
| PEC | BIC26PEL354 | Image Processing & Computer Vision | Lecture | 3 | 3 | - | 60 | 40 | 100 | - | 16 | 40 |
| PEC | BIC26PEL355 | Optical Instrumentation | | | | | | | | | | |
| PEC | BIC26PEL356 | Cloud Computing | | | | | | | | | | |
| **Program Elective - III** | | | | | | | | | | | | |
| PEC | BIC26PEL357 | Neural Network & Genetic Algorithm | Lecture | 4 | 4 | - | 60 | 40 | 100 | - | 16 | 40 |
| PEC | BIC26PEL358 | Artificial Intelligence & Machine Learning | | | | | | | | | | |
| MDM | MDM | Refer MGMU MDM Basket | Lecture | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| VSEC | BIC26VSP359 | Electronic Workshop | Practical | 2 | | 4 | 30 | 20 | 50 | - | 8 | 20 |
| | | | **TOTAL** | **22** | **18** | **8** | **450** | **300** | **750** | | | |

Exit option to qualify for B.Voc in Instrumentation and Control Engineering,: After securing all credits of first, second and third year with additional 6 credits in skill-based vocational courses (skill-based courses, internship, mini projects etc) offered during summer vacation after the sixth semester.
(As per Annexure - I ).

- **Skill-based vocational course 1: 03 credits (Smart Transmitters & Configuration)**
- **Skill-based vocational course 2: 03 credits (Instrument Installation & Mounting)**

Program core course, PEC: Program Elective Course, MDM: Multidisciplinary minor, OE: Open Elective, RM: Research Methodology, VSEC: Vocational and skill Enhancement Course, EEMC: Entrepreneurship/Economics/Management Course, VEC: Value Education course AEC: Ability Enhancement Course

| Semester VII | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Category** | **Course Code** | **Course Title** | **Nature of Course** | **No of Credits** | **Teaching (Contact hrs/ week)** | | **Evaluation Scheme (Marks)** | | | **Minimum Passing (Marks)** | | |
| | | | | | **L** | **P** | **Internal** | **External** | **Total** | **Internal** | **External** | **Total** |
| PCC | BIC26PCL401 | PLC, DCS & SCADA-II | Lecture | 3 | 3 | - | 60 | 40 | 100 | - | 16 | 40 |
| PCC | BIC26PCP401 | PLC, DCS & SCADA- II lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| PCC | BIC26PEL402 | Analytical Instrumentation | Lecture | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| PCC | BIC26PEP402 | Analytical Instrumentation Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| PCC | BIC26PEL403 | Biomedical Imaging Techniques | Lecture | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| PCC | BIC26PEP403 | Biomedical Imaging Technique Lab | Practical | 1 | - | 2 | 30 | 20 | 50 | - | 8 | 20 |
| RM | MGM21RML401 | Research Methodology | Lecture | 4 | 4 | - | 60 | 40 | 100 | - | 16 | 40 |
| RP | BIC26RRPJ405 | Project | Practical | 4 | - | 8 | 60 | 40 | 100 | - | 16 | 40 |
| MDM | MDM | Refer MGMU MDM Basket | Lecture | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| MDM | MDM | Refer MGMU MDM Basket | Lecture | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| | | | **TOTAL** | **22** | **15** | **14** | **510** | **340** | **850** | | | |

| Semester VIII | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Category** | **Course Code** | **Course Title** | **Nature of Course** | **No of Credits** | **Teaching (Contact hrs/ week)** | | **Evaluation Scheme (Marks)** | | | **Minimum Passing (Marks)** | | |
| | | | | | **L** | **P** | **Internal** | **External** | **Total** | **Internal** | **External** | **Total** |
| **Program Elective - V** | | | | | | | | | | | | |
| PEC | BIC26PEL451 | Quantum Computing | Lecture | 3 | 3 | - | 60 | 40 | 100 | - | 16 | 40 |
| PEC | BIC26PEL452 | Control System Design Techniques | | | | | | | | | | |
| PEC | BIC26PEL453 | Process Modeling Simulation And Optimization | | | | | | | | | | |
| **Program Elective - VI** | | | | | | | | | | | | |
| PEC | BIC26PEL454 | Data Science | Lecture | 3 | 3 | - | 60 | 40 | 100 | - | 16 | 40 |
| PEC | BIC26PEL455 | Machine Learning | | | | | | | | | | |
| PEC | BIC26PEL456 | Big Data Analytics | | | | | | | | | | |
| **Program Elective - VII** | | | | | | | | | | | | |
| PEC | BIC26PEL457 | Biomedical Instrumentation-Ii | Lecture | 2 | 2 | - | 60 | 40 | 100 | - | 16 | 40 |
| PEC | BIC26PEL458 | Automotive Instrumentation | | | | | | | | | | |
| PEC | BIC26PEL459 | Power Plant Instrumentation | | | | | | | | | | |
| Project | BIC26JTI360/ BIC26RPJ360 | Internship/Major Project | Practical | 12 | - | 24 | 90 | 60 | 150 | - | 20 | 60 |
| | | **Total** | | **20** | **8** | **24** | **270** | **180** | **450** | | | |

For Honor course (**Please refer the Annexure B.**)

For Specialization Minor course (Please refer the Annexure C.)

For Honors with Research (Please refer the Annexure D.)

**Total Credits =22+22+22+22+22+22+22+20=174**

## Exit Options After FY, SY and TY

## NAME OF THE PROGRAMME: One Year UG Certificate in Tech (Discipline)

### Name of the Work based Vocational Courses (8 Credits)

| Course Category | Course Code | Course Title | Nature of Course | No. Of Credits | Teaching (Contact hrs/week) | | Evaluation Scheme (Marks) | | | Minimum Passing (Marks) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | P | Internal | External | Total | Internal | External | Total |
| VLC | BIC26VSP101 | Elements of Basic Electronics | Practical | 4 | - | 8 | 60 | 40 | 100 | - | 16 | 40 |
| VLC | BIC26VSP102 | Digital Electronics | Practical | 4 | - | 8 | 60 | 40 | 100 | - | 16 | 40 |

## NAME OF THE PROGRAMME: UG Diploma in the Relevant Discipline

### Name of the Skill-based vocational courses (8-credits)

| Course Category | Course Code | Course Title | Nature of Course | No. Of Credits | Teaching (Contact hrs/week) | | Evaluation Scheme (Marks) | | | Minimum Passing (Marks) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | P | Internal | External | Total | Internal | External | Total |
| VLC | BIC26VSP201 | MATLAB | Practical | 4 | - | 8 | 60 | 40 | 100 | - | 16 | 40 |
| VLC | BIC26VSP202 | Excel Programming | Practical | 4 | - | 8 | 60 | 40 | 100 | - | 16 | 40 |

## NAME OF THE PROGRAMME: B.Voc. In the Relevant Discipline

### Name of the B.Voc. In the relevant Discipline (6 Credits)

| Course Category | Course Code | Course Title | Nature of Course | No. Of Credits | Teaching (Contact hrs/week) | | Evaluation Scheme (Marks) | | | Minimum Passing (Marks) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | P | Internal | External | Total | Internal | External | Total |
| VLC | BIC26VSP301 | Smart Transmitters & Configuration | Practical | 3 | - | 6 | 60 | 40 | 100 | - | 16 | 40 |
| VLC | BIC26VSP202 | Instrument Installation & Monitoring | Practical | 3 | - | 6 | 60 | 40 | 100 | - | 16 | 40 |

# Syllabus
## Semester –I

**Course Code:**APS21BSL101 **Course Name:** Single and Multivariable Calculus **Course Category:** BSC
**Credits:** 4 **Teaching scheme:** L-4 **Evaluation scheme:** CA–60, ESE–40
**Pre-requisites:** Pre-University Mathematics.

**Course Objectives:**

1. To provide the basic tools of calculus for the purpose of modeling the engineering problems mathematically and obtaining solutions.
2. To convey a sense of the utility of calculus and develop technical competence of the student.

**Course Outcomes:**

On completion of the course, the student should be able to:

CO1. Compute derivatives in engineering problems.

CO2. Compute definite integrals arise in the problems such as arc length, surface of revolution, Work and Fluid Forces.

CO3. Find the partial derivatives and apply the knowledge of partial differentiation to find maxima and minima of functions, Jacobeans, estimating error and approximation.

CO4. Calculate Area, Volume, Center of mass and Gravity using Double and Triple integral.

CO5. Solve the problems on fundamental theorems of vector calculus such as Green's, Stokes and Divergence theorems

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Differentiation and its Applications:** Limit ,Continuity and Differentiation, Rate of Change in sciences and Engineering, Chain Rule and implicit differentiation, Related rates, Extreme value theorem, Rolle's Theorem, Lagrange's Mean value theorems, Nth derivatives, Taylor and Maclaurin series Expansions, Linear approximations and Differentials. | 10 |
| 2 | **Integration and its Applications:** Integration, Reduction formulae, Beta and gamma function, Properties, Evaluation of integrals using Beta and gamma functions, Application of Definite integrals to volume, arc length, surface of revolution, Work and Fluid Forces. | 10 |
| 3 | **Partial Differentiation and its Applications:** Limit and Continuity, Partial derivatives of first and higher orders, Total differentials, Errors and Approximations, Total derivative, Extreme values and saddle points, Method of Lagrange multipliers, Jacobeans, Vector differentiation, Gradient, Curl and Divergence, directional derivatives. | 10 |
| 4 | **Multiple Integrals and its Applications:** Double integrals, Evaluation of Double integrals**,** Change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: Area and Volume, Root mean square value, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian),Volume by triple integration. | 10 |
| 5 | **Vector Integration and its Applications:** Line integrals, Surface integrals, Green's Theorem, Stokes Theorems, Divergence theorems. | 10 |

| |
|---|
| **Text Books:** |
| 1. James Stewart, Calculus Early Transcendental, 7th edition, Cengage. |
| 2. George B. Thomas, Ross L. Finney, Calculus and Analytical Geometry, 9th edition, Pearson. |
| 3. Howard Anton, Irl Bivens, Stephens Davis, Calculus, 10th Edition, Wiley. |
| |
| **Reference Books:** |
| 1. Shanti Narayan, Differential Calculus, S. Chand & Co. |
| 2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New York. |
| 3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi. |
| 4. P. N. Wartikar, J. N. Wartikar, Applied Mathematics (Vol I & II) , Pune Vidyarthi Griha Prakashan, Pune. |
| 5. H. K. Das and Rajnish Verma, Higher Engineering Mathematics , S. Chand & CO. Pvt. Ltd., New Delhi. |
| 6. K. D Joshi, Calculus for Scientists and Engineers, CRC Press. |
| 7. Prasad and Reena Garg, Advanced Engineering Mathematics, Khanna Publishing Company Private Limited, New Delhi. |
| |
| **Reference Books:** |
| 1. Shanti Narayan, Differential Calculus, S. Chand & Co. |
| 2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New York. |
| |

**Course Code:**APS21BSL102 **Course Name:** Engineering Physics **Course Category:** BSC

**Credits:** 3 **Teaching scheme:** L-3 **Evaluation scheme:** CA–60, ESE–40

**Pre-requisites:** Student Should Know Basic Physics And Basic Mathematics

**Course Objectives:**

1. To impart knowledge in basic concepts of physics relevant to engineering applications
2. To introduce advances in technology for engineering applications.

**Course Outcomes:**

On completion of the course, the student should be able to:

**CO.1** Summarize fundamentals of electron optics, modern physics and ultrasonic waves related to the engineering fields.

**CO.2** Identify the importance of the optical phenomenon i.e. interference, diffraction and polarization in relevance with its engineering applications.

**CO.3** Classify the material on the basis of electric conductivity as semiconductor and superconductors and dielectric materials this leads to their fascinating applications.

**CO.4** Recognize the use of laser and optical fibers in various fields.

**CO.5** Outline basics of crystallography and X- rays and demonstrate the applications of nano-materials relevant to engineering program.



**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Modern Physics:**<br>Electron Optics: e/m by Thomson's method, Positive ray, Bainbridge mass spectrograph.<br>Quantum Mechanics: Role and concepts, De- Broglie's hypothesis, Uncertainty Principle,<br>Fundamentals of quantum computing, Quantum features<br>Ultrasonic Waves: Production of ultrasonic waves (Magnetostriction & Piezoelectric method), Applications.<br>Numericals. | 8 |
| 2 | **Wave Optics:**<br>Interference- Interference in thin films (reflected light), Newton's Rings, Engineering applications of Interference.<br>Diffraction- Fresnel's and Fraunhofer Diffraction, Theory of plane transmission Grating.<br>Polarization-Polarization by reflection and double refraction, Optical activity, Specific rotation, Construction and working of Laurent's half shade | 8 |

| | | |
|---|---|---|
| | polarimeter, Engineering applications of Polarization.<br>Numericals. | |
| 3 | **Materials of Technological Importance:**<br>Dielectric Materials: Introduction, Types of polarizations: Electronic and Ionic, Orientation Polarizations - Applications of Dielectrics<br>Semiconducting Materials: Introduction, Fermi energy in Intrinsic semiconductors and extrinsic semiconductors, Hall effect, Applications of Semiconductors. Numericals.<br>Superconducting Materials: Introduction, Type – I and Type – II superconductors, Meissner effect, BCS Theory, Application | 8 |
| 4 | **Optoelectronic Materials and Devices:**<br>LASER : Absorption, spontaneous and stimulated emission, population inversion<br>n, pumping mechanism, Construction and working of Ruby laser, Construction and working of He-Ne laser. Lasers in various technological applications.<br>Introduction to Optical Fibers-Introduction Acceptance Angle-Numerical Aperture, Applications of optical fibers.<br>Numericals. | 8 |
| 5 | **Physics of Materials:**<br>Crystal structure: Unit cell, Coordination number, atomic radius, packing density of cubic system.<br>X-rays: Bragg's law, X-Ray Diffraction (XRD), Industrial Applications of X-Rays. Numericals.<br>Particle detector: G.M. Counter<br>Nano-Materials: Basic principles of Nano science and technology, properties, applications of nanotechnology. | 8 |

| **Text Books:** |
|---|
| ● Engineering Physics- H.K. Malik & A.K. Singh, McGraw Hill publication. |
| ● Engineering Physics - R.K. Gaur and S. L. Gupta. Dhanpat Rai Publications Pvt. Ltd.-New Delhi |
| ● M. N.Avadhanulu, P.G.Kshirsagar "A Text book of Engineering Physics"-S. Chand Publications. |
| ● B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2012. |
| |
| **Reference Books:** |
| 1. Fundamental of Physics - Halliday and Resnik. Willey Eastern Limited. |
| 2. Introduction to Electrodynamics –David R. Griffiths. |
| 3. Concept of Modern Physics – Arthur Beizer. Tata McGraw-Hill Publishing Company Limited. |
| 4. Optics – AjoyGhatak.MacGraw Hill Education (India) Pvt. Ltd. |
| 5. Science of Engineering Materials- C.M. Srivastava and C. Srinivasan. New Age International Pvt.Ltd. |
| 6. Solid State Physics – A.J. Dekker. McMillan India –Limited. |

| |
|---|
| 7. The Feynman Lectures on Physics Vol I, II,III. |
| 8. Introduction to solid state physics – Charles Kittel. John Willey and Sons |
| 9. T Pradeep "A Text book of Nano Science and Nano Technology"-Tata Mc GrawHill 2019. |
| |
| **E-Resources:** |
| 1. https://nptel.ac.in/courses/122107035/ Engineering Physics |
| 2. https://youtu.be/98xoZknQjl8 Polarization |
| 3. https://youtu.be/yINtzw63KncMaxwell's Equations and EM theory |
| 4. https://youtu.be/bwreHReBH2AMaxwell's Equations and EM theory |
| 5. https://www.youtube.com/playlist?list=PLuv3GM6-gsE3-hVNaw-YEb7EeY5XVPZdz Maxwell's Equations and EM theory(nptel) |
| 1. https://nptel.ac.in/courses/115105120/ Experimental Physics |
| 2. https://youtu.be/2CsMpEBl5QY Crystal Structure and X- rays |
| 3. https://youtu.be/z_8aJPLr21E Crystal Structure and X- rays |
| 4. https://youtu.be/_Ckh-60B6LY Condensed matter Physics |
| 5. https://youtu.be/QQZ6EGf0Ju8 Magnetic Properties |
| 6. https://youtu.be/DDLljK1ODeg Magnetic Materials |
| 7. https://youtu.be/etjZmdmrjSU Dielectrics |
| 8. https://youtu.be/k6ZxP9Yr02E Semiconductor |
| 9. https://youtu.be/D-9M3GWoBrw Superconductivity |
| 10. https://youtu.be/GglT1RoBPzg Superconductivity |
| 11. https://youtu.be/VHp2Ff5N_bs Superconductivity |
| 12. https://youtu.be/FNp81kkxj5c LASER |
| 13. https://youtu.be/YvrwVK9ZqQY LASER |
| 14. https://nptel.ac.in/courses/115107095/ Optic Fiber |
| 15. https://youtu.be/cjBPnIXK60U Quantum Mechanics ( Prof.H.C. Verma) |
| 16. https://youtu.be/BDuqChhUhM0 Divergence and Curl(Prof.H.C. Verma) |
| 17. https://youtu.be/sCviGSMaYfI Divergence and Curl ( Prof.H.C. Verma) |
| 18. https://youtu.be/SZCsFS9izfQ Divergence and Curl And other related videos from following resources |
| 19. www.nptel.ac.in ;www.swayam.gov.in;https://inflibnet.ac.in/ |
| 20. www.sciencedirect.com |
| 21. http://vlabs.iitb.ac.in/vlab/ |
| 22. www.youtube.com |
| 23. https://nptel.ac.in/courses/122107035/ Engineering Physics |

**Course Code:**APS21ESL101 **Course Name:** Python Programming **Course Category: ESC**
**Credits:** 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40
**Pre-requisites:** Basic Computer Knowledge& Knowledge Of Any Programming Language (Optional)

**Course Objectives:**

1. To understand fundamental concepts in Python Programming
2. To learn the different Conditional Loops and Iteration
3. To understand various data structures and packages

**Course Outcomes:**

**CO1:** Describe programming fundamentals of python.
**CO2:** Interpret the python syntax and semantics of control flow statements.
**CO3:** Identify the methods to create and manipulate programs with python data structures.
**CO4:** Use modular approach for problem solving.
**CO5:** Apply advanced features and packages of python programming required for data science.

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Python for everybody:** Why Program, Hardware Overview, Python as a Language, Why Python, Installation Python Jupiter notebook, Using the Python Playground ,how to write program and compile in Jupiter notebook. Writing input and output statements in Python, output formatting, Writing comments, keywords in Python .variables and variable assignments, Operators ,writing expressions | 6 |
| 2 | **Conditional Loops and Iteration:** Conditional Statements, in Python, Loops and Iteration, Definite Loops, Finding the Largest Value, Loop Idioms | 6 |
| 3 | **Data Structures in Python:** Strings, Manipulating Strings, Files, Processing Files, Dictionaries, sets, Tuple, Lists, Manipulating Lists, Lists and Strings, Strings, Manipulating Strings | 6 |
| 4 | **Functions, Modules and Packages:** Functions, Lambda functions, Recursive function, Types of functions, modules and packages. | 6 |
| 5 | **Packages in Python for Data Science:** NumPy introduction, Numerical operations on NumPy, Introduction of Matplotlib, getting started with Pandas, Data frames basics in Pandas, key operations on data frames. Introduction to Data Science, Binary search, finding elements in common in lists using Hash, Finding largest elements, Introduction of SQL | 6 |

| **Text Books:** |
|---|
| 1. Kent D. Lee, “Python Programming Fundamentals”, Second Edition, Springer Publication. |
| 2. Wes McKinney, “Python for Data Analysis” O’Reilly Publication. |
| |
| **Reference Books:** |
| 1. The Python Language Reference: http://docs.python.org/2/reference/index.html |
| 2. The Python Standard Library: http://docs.python.org/2/library/ |
| 3. https://docs.scipy.org/doc/scipy/reference/tutorial/stats.html |
| 4. http://matplotlib.org/api/mlab_api.html#module-matplotlib.mlab |
| 5. http://conference.scipy.org/proceedings/scipy2010/pdfs/seabold.pdf |
| 6. http://seaborn.pydata.org |
| 7. https://www.datacamp.com/community/data-science-cheatsheets |
| 8. PEP 20 -- The Zen of Python: https://www.python.org/dev/peps/pep-0020/ |
| 9. https://docs.scipy.org/doc/numpy-dev/user/numpy-for-matlab-users.html |
| |
| **General Instructions:** |
| The theory classes are to be conducted batch wise in Lab. Each class should be divided into four batches. |

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|---|
| **Course Code:**APS21SL102 **Course Name:** Engineering Graphics **Course Category:** ESC<br>**Credits:** 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40<br>**Pre-requisites:** Nil |
| **Course Objectives:**<br>1. Understand the basic principles of engineering graphics and improve the visualization skills<br>2. To gain knowledge on projection of points, straight lines, planes, solids.<br>3. To understand the real life objects through Drawings.<br>4. To know the principles of orthographic and isometric projections. |
| **Course Outcomes:**<br>CO 1. Identify basic concepts in drawing and its application.<br>CO 2. Plan and prepare neat orthographic drawings of points, straight lines, planes and solids.<br>CO 3. To visualize and draw orthographic and isometric projection of solids.<br>CO 4. Acquire skill to draw real life engineering objects by using the engineering drawing |

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Projections of Straight Lines:**<br><br>Introduction to Engineering Graphics, Need of Engineering Drawing, Drawing Instruments, BIS code of practice for general engineering drawing, Projections of Points in Four Quadrants, Projections of Points<br><br>in Reference Plane, Line Parallel to both the Plane, Line Parallel to One Plane and Perpendicular to the other, Line Inclined to One Plane and Parallel to The Other, Line Inclined to Both the Reference Planes, Traces of Line (Only first quadrant to be considered) | 5 |
| 2 | **Engineering Curves:**<br><br>Curves used in Engineering Practice, Conic sections, Construction of conics by different methods, Rectangular-hyperbola, Cycloidal curves, Epi and hypo-cycloids, Involutes and Archimedean spiral. | 5 |
| 3 | **Projections of Planes:**<br><br>Plane with Surface Parallel to One Plane and Perpendicular to other, Plane Inclined to One Plane and Perpendicular to other, Projections of Planes Inclined to both the Planes | 5 |
| 4 | **Projections of Solids:**<br><br>Introduction to Solids: Prisms, Pyramid, Cylinder, Cone, Cube,<br><br>Tetrahedron, Sphere, Projections of above Solids with Axis inclined to one plane, Projections of above solids with Axis inclined to both the Planes, | 5 |

| | | |
|---|---|---|
| | Projection of composite solids (different arrangement of Spheres with above Solids). | |
| 5 | **Orthographic Projections:**<br><br>Orthographic projections of different Machine Parts (First Angle Projection method only) | 5 |
| 6 | **Isometric Projections ,Introduction to CAD:**<br><br>Introduction to Pictorial views, Converting Orthographic Projections into Isometric Projections and Isometric views. Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects | 5 |

| **Text Books:** |
|---|
| 1. N. D. Bhatt and Panchal V. M., "Engineering Drawing", Charotar Publishing House, Anand |
| 2. P. J. Shah , " A Text Book of Engineering Drawing", S.Chand, New Delhi |
| 3. Shah M.B. & Rana B.C, "Engineering Drawing & Computer Graphics", Pearson Publications, |
| 4. Agrawal B.& Agrawal C.M, "Engineering Graphics", TMH Publications |
| 5. Narayana K.L. & P. Kannaiah, "Engineering Drawing", Scitech Publications |
| 6. P.I Vargese, "Engineering Graphics", Mcgraw Hill Publications |
| 7. D.A.Hindoliya," Engineering Graphics", B. S. Publications |
| |
| **Reference Books:** |
| 1. Dabhade M. L., "Engineering Graphics", Vol.-I and Vol.-II, Vision Publications, Pune |
| 2. K.Venugopal, "Engineering Drawing and Graphics" ,New Age International Publishers |

| |
|---|
| **Course Code:**MGM54AEL101 **Course Name:** Communicative English **Course Category:**AEC<br>**Credits:** 1 **Teaching scheme:** L-1 **Evaluation scheme:** CA–30, ESE–20<br>**Pre-requisites:** Basic knowledge of English |
| **Course Objectives:**<br>The course aims at grooming the professional ethics of the students through various personality traits and behavioral patterns focusing on communication skills. |
| **Course Outcomes:**<br>**CO.1** communicate formally with enhanced communication Competency<br>**CO.2** to adapt professional nonverbal communication<br>**CO.3** construct English formal syntax and apply corporate vocabulary in written and verbal communication<br>**CO.4** acquire listening and drafting skills with professional competency |

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Communication and Communication Process:**<br>Introduction to Communication, Forms and functions of Communication, Barriers to Communication and overcoming them, Ways of Effective Communication. | 5 |
| 2 | **Non-verbal Communication And its types:**<br>Kinesics, Occulesics, Appearance, Proxemics, Chronemics, Paralanguage, Qualities of effective speech | 3 |
| 3 | **English Grammar:**<br>Overview of basic Mid-level grammar, Tenses & concept of time Sentence construction, Corporate vocabulary, Difference between formal and informal sentences, phrases and words | 3 |
| 4 | **Listening Skills and Writing Skills:**<br>Listening : Active and Passive Listening writing styles layouts Business Letters- job application, resignation, resume | 4 |

| **Text Books/ Reference Books:** |
|---|
| 1. Ashraf Rizvi, Communication Skills for Engineers, Tata McGraw Hill |
| 2. Sanjay Kumar, Pushp Lata, Communication Skills, Oxford University Press, 2016. |
| 3. Meenakshi Raman, Sangeeta Sharma, Communication Skills, Oxford University Press, 2017. |
| 4. Teri Kwal Gamble, Michael Gamble, Communication Works, Tata McGraw HillEducation,2010. |
| 5. Anderson, Kenneth. Joan Maclean and Tossny Lynch. Study Speaking: A Course in Spoken English for Academic Purposes. Cambridge: CUP, 2004. |
| 6. Bellare, Nirmala. Reading Strategies.Vols.1 and 2. New Delhi. Oxford University Press,1998 |
| 7. Bhasker, W.W. S & Prabhu, N.S.: English through Reading, Vols.1 and 2. Macmillan,1975 |
| 8. Bovee Courtland, Land Thrill, John V. Business Communication, Today McGraw Hill, New York, |
| 9. Taxman Publication (1989). |
| 10. Murphy, Raymond. Essential English Grammar, Cambridge: University Press (2000) |
| 11. Hewings Martin Advanced English Grammar Cambridge : University press (2003) |
| 12. Bansal Harrison. Spoken English |

**Course Code:**APS21VSP101 **Course Name:** Engineering Exploration **Course Category: VSEC**

**Credits:** 2 **Teaching scheme:** P-4 **Evaluation scheme:** CA–60, ESE–40

**Pre-requisites:** Nil

**Course Objectives:**

1. Understand the principles of Engineering Design and apply them to identify product requirements, objectives, and constraints through interactions with clients, users, and relevant stakeholders.
2. Develop critical thinking and problem-solving skills to analyze existing technologies, conduct surveys, study literature, and generate creative design concepts using various means and combinations.
3. Acquire proficiency in using appropriate tools and techniques to generate electronic and mechanical simulations, schematic diagrams, and product concept sketches or CAD models for effective communication of design ideas.
4. Demonstrate competency in categorizing inputs and outputs of systems in terms of materials, information, and energy, enabling a holistic understanding of engineering projects.
5. Cultivate effective teamwork and communication skills to collaborate with peers, mentors, and team members during the development and presentation of engineering prototypes.
6. Develop the ability to evaluate, defend, and communicate design decisions, progress, and project outcomes, showcasing awareness of course concepts and their application in real-world scenarios.



**Course Outcomes:**

On completion of the course, the student should be able to:

LO 1. Effectively interact with clients, users, and stakeholders to gather relevant information and derive product requirements, thereby demonstrating proficiency in Requirement Analysis and Client Interaction.

LO 2. Analyze and compare existing technologies, conduct surveys, and study literature to identify potential solutions, and develop objective trees and function trees, reflecting their competency in Conceptual Design and Analysis.

LO 3. Create product concept diagrams, combining different means, and prepare sketches or CAD models to present their design ideas aesthetically and coherently, indicating proficiency in Product Concept Development.

LO 4. Categorize system inputs and outputs in terms of materials, information, and energy, illustrating their understanding of System Categorization and Analysis.

LO 5. Exhibit hands-on skills in physical assembly, connection, and demonstration of engineering prototypes, showcasing Proficiency in Prototyping and Implementation.

LO 6. Explain and defend their design choices, project progress, and outcomes during presentations, demonstrating Communication Skills, Project Evaluation, and Awareness of Engineering Concepts.

**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | The course is conducted in the following modules:<br>1. Introduction to Engineering Exploration<br>2. Engineering Design<br>3. Platform Based Development<br>4. Mechanisms<br>5. Data acquisition and analysis<br>6. Engineering Ethics<br>7. Project Management | 10 |
| 2 | The following practical contents are delivered in an integrated mode along with theory:<br>1. Conceptualizing a product<br>2. Designing a product with constraints<br>3. Simulation of electronic circuits (at least 10 sets)<br>4. Implementation of electronic circuits (at least 5 sets)<br>5. Implementation of four bar chain mechanism<br>6. Conversion of problem statement to need statement<br>7. Identification of objectives, constraints and functions<br>8. Generation of black box, glass box and expanded class box<br>9. Generation of morphological chart<br>10. Generation of concepts<br>11. Comparison of concepts<br>12. Selection of concept<br>13. Implementation and testing of prototype | 20 |



| **Reference Books:** |
|---|
| • George E. Dieter and Linda C. Schmidt (2009), Engineering Design, 4ed, Mc Graw Hill Higher Education |
| • Clive L. Dym, Patrick Little, and Elizabeth J. Orwin (2014), Engineering Design: A project-based introduction, 4ed, John Wiley and Sons |
| • G. Pahl, W. Beitz, J. Feldhusen and K.-H. Grote (2007), Engineering Design: A systematic approach, 3ed, Springer, New York |

**Course Code:**APS21BSP101 **Course Name:** Engineering Physics Lab **Course Category: BSC**
**Credits:** 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20
**Pre-requisites:** Student should know the basic aspects of measurements like least count and range of instrument, scale identification, accuracy, error etc.

**Course Objectives:**

The Objective of this course is

1. To make the students gain practical knowledge to co-relate with the theoretical studies.
2. To achieve perfectness in experimental skills.
3. The study of practical applications will bring more confidence.

**Course Outcomes:**

At the end of the laboratory course, the students will be able to,

LO1: Plot the I-V characteristics of pn junction diode and determine the value of band gap energy which can be used for core engineering Courses.

LO2: Perform optical experiments; using light properties like interference, polarization, diffraction and their applications.

LO3: Interpret the results and analyze the data and use the experimental data to plot the graph for a best fit.

LO4: Discuss the characteristics of plateau region and determine operating voltage of G.M. counter

LO5: Determine the numerical aperture and bending loss of optical fibre cable

**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | Thomson's Bar Magnetic method -Determination of e/m of electron | 02 |
| 2 | Newton's rings -Determination of radius of curvature of Plano convex lens. | 02 |
| 3 | Polarization - Half shade Polarimeter -Determination of specific rotation of optically active material. | 02 |
| 4 | Diffraction - Determination of wavelength of light by plane transmission grating. | 02 |
| 5 | Wedge Shaped film -Determination of thickness of thin wire | 02 |
| 6 | Semiconductors – To study of forward and rev-*-*/----------erse bias characteristic of Semiconductors diode | 02 |
| 7 | Fibre Optics – Determination of Bending losses in optical fibre | 02 |
| 8 | Fibre Optics – Determination of Numerical Aperture of given optical fibre | 02 |
| 9 | Determination of operating voltage of G.M. tube and characteristics of plateau region | 02 |
| 10 | Determination of wavelength of laser source | 02 |

**Course Code:**APS21ESP101 **Course Name:** Python Programming Lab **Course Category:**AEC

**Credits:** 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20

**Pre-requisites:** Nil

**Course Objectives:** The Objective of this course is

**Course Outcomes:**

**LO1:** Demonstrate python program using development environment.

**LO2:** Develop logical thinking to solve the problems using programming fundamental concepts.

**LO3:** Construct python program using various data structures.

**LO4:** Apply modularization approach for solving complex problem.

**LO5:** Make use of various packages in Python for data science.

**LO6:** Implement different SQL commands in python.

**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | **Program to perform input/output operations**<br>Write a program to take input (integer, float, string) and print it. | 02 |
| 2 | **Program based on operators**<br>1. Write a program to simulate a simple calculator (+ - / * %) that takes two<br>2. Write a program to find area and perimeter of geometric objects.<br>3. The distance between two cities (in km.) is input through the keyboard centimeters.<br>4. Write a Program to interchange two numbers.<br>**5.** Write a program to compute Fahrenheit from centigrade | 02 |
| 3 | **Programs based on Decision making.**<br>1. Write a program to read marks from keyboard and your program should display equivalent grade according to following table(else-if ) (ladder)<br>**Marks Grade**<br>100 – 80 Distinction<br>79 - 60 First Class<br>59 - 40 Second Class<br>< 40 Fail<br>2. Write a program to input basic salary of an employee and calculate gross salary according to given conditions.<br>Basic Salary <= 10000 : HRA = 20%, DA = 80%<br>Basic Salary is between 10001 to 20000 : HRA = 25%, DA = 90%<br>Basic Salary >= 20001 : HRA = 30%, DA = 95%<br>3. If the ages of three brothers are input through the keyboard, write a C Program to determine the youngest and oldest of the three.<br>4. Write a program to calculate overtime pay of employee. Overtime is paid at the rate of Rs. 12.00 per hour for every hour worked above 40 | 02 |

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| | hours. Assume that employee do not work for fractional part of an hour.<br>5. Write a program for checking the speed of drivers.<br>**6.** If speed is less than 70, it should print "Ok". Otherwise, for every 5km above the speed limit (70), it should give the driver one demerit point and print the total number of demerit points. For example, if the speed is 80, it should print: "Points: 2". If the driver gets more than 12 points, the function should print: "License suspended" | |
| 4 | **Programs using while and for loops**<br>1. WAP to find factorial of given number<br>2. WAP to check whether given number is Palindrome or not<br>3. WAP to check whether given number is Armstrong or not<br>4. WAP to print Fibonacci series<br>5. Write a Python program which iterates the integers from 1 to 50. For multiples of three print "Fizz" instead of the number and for the multiples of five print "Buzz". For numbers which are multiples of both three and five print "Fizz Buzz".<br>6. WAP to check whether given number is Perfect number or not<br>7. WAP to check whether given number is Prime number or not<br>8. Write C program to print given star and number patterns and reverse it.<br>• * 1<br>• ** 12<br>• *** 123<br>• **** 1234 | 02 |
| 5 | **Programs on string**<br>1. Write Python Program to find length of string without using len() function.<br>2. Count all letters, digits, and special symbols from a given string.<br>3. Python Program to Count the Number of Vowels in a String.<br>4. Python Program to Calculate the Number of Upper Case Letters and Lower Case Letters in a String.<br>5. Python Program to Check whether given string is palindrome or not | 02 |
| 6 | **Programs on List and Tuple**<br>1. Write a Python program to sum all the items in a list.<br>2. Write a Python program to multiply all the items in a list<br>3. Write a Python program to get the largest number from a list.<br>4. Write a Python program to get the smallest number from a list<br>5. Write a Python program to count all elements in list and count Occurrences Of A List Item In Python<br>6. Write a Python program to create a tuple with different data types<br>7. Write a Python program to check whether an element exists within a tuple<br>8. Write a Python program to reverse a tuple<br>9. Write a Python program calculate the product of all the numbers given in tuple. Original Tuple: (2, 4, 8, 8, 3, 2, 9)<br>Product - multiplying all the numbers of the said tuple: 27648 | 02 |
| 7 | **Programs on set and dictionary**<br>1. Write a Python program to concatenate following dictionaries to create a | 02 |

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|---|---|---|
| | new one. Sample Dictionary : dic1={1:10, 2:20} dic2={3:30, 4:40} dic3={5:50,6:60}<br>Expected Result : {1: 10, 2: 20, 3: 30, 4: 40, 5: 50, 6: 60}<br>2. Write a Python program to check whether a given key already exists in a dictionary<br>3. Write a Python script to generate and print a dictionary that contains a number (between 1 and n) in the form (x, x*x)<br>Sample Dictionary ( n = 5) :<br>Expected Output : {1: 1, 2: 4, 3: 9, 4: 16, 5: 25}<br>4. Write a Python program to merge two Python dictionaries<br>5. Write a Python program to get the maximum and minimum value in a dictionary<br>6. Write a Python program to create set difference, Union and intersection<br>7. Write a Python program to check if two given sets have no elements in common | |
| 8 | **Programs using function**<br>1. Write Functions to calculate your trip's costs:<br>2. Define a function called hotel cost with one argument nights as input<br>3. Define a function called plane_ride_cost that takes a string, city, as input.<br>4. Define a function called rental_car_cost with an argument called days.<br>5. Define a function called trip_cost that takes two arguments, city and days. Like the example above, have your function return the sum of calling the rental_car_cost (days), hotel_cost(days), and plane_ride_cost(city) functions.<br>6. Write a program in to check a given number is even or odd using the function.<br>7. Write a function Exchange to interchange the values of two variables, say x and y. illustrate the use of this function in a calling function.<br>8. Write a program to find Sum of natural number using recursion.<br>9. Write a program to print Fibonacci series number using recursion | 02 |
| 9 | **Program using NumPy, Matplotlib and Pandas library**<br>1. Write a program to perform matrix addition, subtraction, multiplication.<br>2. Plot all types of graph using Matplotlib.<br>3. Write a program which performs basic operation of Pandas. | 02 |
| 10 | **Program on SQL Commands**<br>1. Write a program of binary search<br>2. Write a program which perform basic SQL commands<br>3. Programs based on real life problems/GUI based programs | 02 |

**Course Code:**APS21ESP102 **Course Name:** Engineering Graphics Studio **Course Category:**AEC

**Credits:** 2 **Teaching scheme:** P-4 **Evaluation scheme:** CA–30, ESE–20

**Pre-requisites:** Nil

**Course Objectives:**

The Objective of this course is

**Course Outcomes:**

**Students will be able to,**

1. Develop competence in correct expression of the visualized objects
2. Dimension and annotate two-dimensional engineering drawings
3. Plan and prepare neat orthographic drawings of points, straight lines, planes and solids
4. Develop the ability to visualize and draw orthographic and isometric projection of solids

**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | Drawing three problems based on projections of lines on half imperial size drawing sheet | 02 |
| 2 | Drawing three problems based on engineering curves on half imperial size drawing sheet | 02 |
| 3 | Drawing three problems based on projections of planes on half imperial size drawing sheet | 02 |
| 4 | Drawing three problems based on projections of solids on half imperial size drawing sheet | 02 |
| 5 | Drawing three problems based on orthographic projections on half imperial size drawing sheet | 02 |
| 6 | Drawing three problems based on isometric projections on half imperial size drawing sheet | 02 |
| 7 | Demonstration of CAD software in CAD lab, drawing simple objects using various commands | 02 |

**Course Code:**APS21ESP103 **Course Name:** Recent Trends in Integrated Technologies Lab **Course Category:** ESC

**Credits:** 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20

**Pre-requisites:** Nil

**Course Objectives:**

1. To introduce students the basics of additive manufacturing/rapid prototyping and its applications in various fields, reverse engineering techniques.
2. To recognize industrial control problems suitable for Industrial Robotics.
3. To acquire basic skills in exploring the potential of the drone technology in professional activities
4. Ability to recognize industrial automation problems suitable for PLC control.

**Course Outcomes:**

LO1 Prepare 3D Model (slice & print) in either Strategy's or Zortrax & generate scan data through Hexagon portable scanning arm.

LO2 Describe basic industrial robotics & it's applications

LO3 Operate a small drone in a controlled environment

LO4 Explain principles of sensor, PLC & applications.

**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | Scan to CAD, CAD to STL conversion& patching, machine setup & processes for printing | 02 |
| 2 | Programming the TATA Robot( pendant) for pick & place, programming the Yaskawa Robot( pendant) for motion planning, Demonstrate welding exercise by the instructor | 02 |
| 3 | Introduction to components of drone, Demonstration of assembly of drone, Demonstration of mission planning & flying the drone | 02 |
| 4 | Controller & sensor & their interfacing, basic ladder logic instructions, pneumatic& hydraulic actuator | 02 |

**Reference Books:**

1. A Step-by-Step Guide For Beginners: Aircraft Design & Construction Design Guide by :Merlin Debrie
2. Industrial Automation & Robotics By A.K. Gupta & S.K.Arora
3. Additive Manufacturing Principles, Technologies & Applications By C.P.Paul (TMH)
4. Basics of unmanned aerial vehicle By Garvit Pandya (Motion press)

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| **Course Code:**MGM54AEP101 **Course Name:** Communicative English Lab **Course Category:**AEC<br>**Credits:** 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20<br>**Pre-requisites:** Basic knowledge of English |
| **Course Objectives:**<br>The course aims at grooming the professional ethics of the students through various personality traits and behavioral patterns focusing on communication skills. |
| **Course Outcomes:**<br>The Students will be able to<br>LO1 Introduce themselves formally and informally through practice.<br>LO2 Pronounce English vowel and Consonant sounds effectively<br>LO3 Participate effectively in G.Ds, Presentations, &Interviews<br>LO4 Face Interviews competently<br>LO5 Draft resume, business letters, reports formally<br>LO6 Comprehend them Learning of English text by comprehension techniques. |

**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | Self Introduction | 02 |
| 2 | Pronunciation of Vowel sounds in English | 02 |
| 3 | Pronunciation of consonant sounds in English | 02 |
| 4 | Group discussion | 04 |
| 5 | Presentation techniques | 04 |
| 6 | Interview techniques | 04 |
| 7 | Letter writing | 04 |
| 8 | Email writing, Agenda of the meeting and notices | 02 |
| 9 | Resume Writing | 02 |
| 10 | Report writing | 02 |
| 11 | Skimming & Scanning | 02 |

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| **Course Code:** MGM82CCP101 **Course Name:** National Cadet Corps **Course Category:** CCA<br>**Credits:**2 **Teaching scheme:** P-4 **Evaluation scheme:** CA–50, ESE–00<br>**Pre-requisites:** Nil |
| **Course Objectives:** Nil |
| **Course Outcomes:** Nil |

**Contents:**

| Unit No. | Content | Hours |
|---|---|---|
| 1 | **NCC General, National Integration and Awareness, Social Service and Community Development, Drill:** Aims, Objectives and Organization of NCC, Duties of NCC Cadet, National Integration Importance and Necessity, Factors Affecting National Integration, Foot Drill, Drill With Arms, Ceremonial Drill with Arms, Social Service and Community Development Activities- Pollution, Mission Indradhanush, Beti Bachao Beti Padhao, Tree Plantation, Digital Awareness. | 12 |
| 2 | **Personality Development, Disaster Management, Weapon Training, Map Reading :** Critical and Creative Thinking, Decision Making, Self Awareness, Public Speaking, Interview Skills, Types, Org, Capability and Role of NCC cadets, Initiative Trg, Organizing Skills, Do's & Don't, Introduction and Characteristics of .22 rifle, Handling of .22 rifle, Introduction to Map Reading, Conduct of MR- Google and Tourist Maps and Apps. | 10 |
| 3 | **Health and Hygiene, Environmental Awareness and Conservation, Adventure, Obstacle Training:** Hygiene & Sanitation (Personal & Camp Hygiene) Soch Vichar, First Aid in Common Medical Emergencies, Treatment & Care of Wounds, Introduction Yoga & Exercises, Water Conservation, Energy Conservation, Introduction Adventure Activities. Obstacle Course. | 10 |
| 4 | **Leadership, Introduction to Infantry Weapons and Equipments:** Traits, Indicators, Motivation, Ethics, Case Studies- Chhatrapati Shivaji Maharaj, Maharana Pratap, Jhasi ki Rani, Ratan Tata, Narayan Murty, Rabindra Nath Tagor, Organization of Infantry Battalion and its weapons. | 08 |
| 5 | **Armed Forces, Field Craft and Battle Craft, :** Armed Forces, Army, CAPF, Police, Modes of Entry to Army, CAPF, Police, Introduction to Field Craft, Indication of Landmark, Observation, Camouflage and Concealment, Fire and Move Capsule. | 08 |

| **References:** |
|---|
| • Cadet's Handbook- Common Subject, all wings by DG NCC, New Delhi. |
| • Cadet's Handbook- Common Subject by NCC Directorate- Bhubaneshwar. |
| • Cadet's Handbook- Specialized Subjects, Army, Navy, Air-Force by DG NCC, New Delhi. |
| • NCC OTA Precise by DG NCC, New Delhi. |
| • Chanakya's 7 Secrets of Leadership by Radhakrishanan Pillai and D. Shivnandhan. |
| • National Cadets Corps (India) by Lambert M. Suvarkar. |
| |
| **E-Resources:** |
| 1. National Cadet Corps, Youth in Action (Google eBook). |
| https://indiancc.nic.in/dg-ncc-lt-gen-gurbirpal-singh/ |

**Course Code:** MGM82CCP103 **Course Name:** Sports **Course Category: CCA**
**Credits:**2 **Teaching scheme:** P-4 **Evaluation scheme:** CA–50, ESE–00
**Pre-requisites:** Nil

**Course Objectives:**

1. To understand the importance of sports in physical and mental development.
2. To learn about the different types of sports.
3. To learn about the different types of indoor games.
4. To participate in indoor games.
5. To learn about the different types of outdoor games.
6. To participate in outdoor games.

**Course Outcomes:**

- Upon completion of this course, students will be able to
- Demonstrate knowledge of the history, benefits, types, equipment, and safety of sports
- Demonstrate proficiency in the basic skills of indoor and outdoor games
- Understand the rules and regulations of selected sports
- Participate in sports competitions

**Contents:**

| Sr. No. | Content | Hours |
|---|---|---|
| 1 | **Football:**<br>History of Football:<br>The earliest forms of football can be traced back to ancient China, Greece, and Rome.<br>In England, the game of football developed in the 19th century, with different rules being used by different schools and organizations.<br>In 1863, the Football Association (FA) was founded, and it standardized the rules of the game.<br>The first international match was played between England and Scotland in 1872.<br>Football became an Olympic sport in 1900, and the first World Cup was held in 1930.<br>Today, football is the most popular sport in the world, with billions of fans around the globe.<br>**Fundamental Skills of Football**<br>**Dribbling:** Dribbling is the ability to move the ball with your feet while keeping control of it. It is a essential skill for all footballers, as it allows you to move past defenders and create scoring opportunities.<br>Passing: Passing is the ability to accurately and effectively throw the ball to your teammates. It is another essential skill, as it allows you to move the ball up the field and create scoring opportunities.<br>Shooting: Shooting is the ability to kick the ball with power and accuracy. It is the most important skill for scoring goals, and it is essential for all footballers to develop a good shot.<br>Heading: Heading is the ability to use your head to control and direct the ball. It | 12 |

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| | is a valuable skill for both attacking and defending, and it is important for all footballers to learn how to head the ball effectively.<br>Tackling: Tackling is the ability to take the ball away from an opponent. It is an important skill for defenders, but it is also valuable for midfielders and attackers. | |
| 2 | **Basket Ball**<br>**History of Basketball**<br>Basketball was invented by James Naismith in 1891 at the International YMCA Training School in Springfield, Massachusetts.<br>Naismith was a physical education instructor who was looking for a game that would be less injury-prone than football.<br>He nailed two peach baskets to the lower rail of a balcony and used a soccer ball to play the game.<br>The first game of basketball was played on December 21, 1891, with nine players on each team.<br>The rules of basketball have evolved over time, but the basic premise of the game has remained the same.<br>Today, basketball is one of the most popular sports in the world, with millions of players and fans around the globe.<br><br>**Fundamental Skills of Basketball**<br>Dribble: Dribbling is the ability to move the ball with your hands while keeping control of it. It is an essential skill for all basketball players, as it allows you to move past defenders and create scoring opportunities.<br>Passing: Passing is the ability to accurately and effectively throw the ball to your teammates. It is another essential skill, as it allows you to move the ball up the court and create scoring opportunities.<br>Shooting: Shooting is the ability to throw the ball through the hoop with power and accuracy. It is the most important skill for scoring points, and it is essential for all basketball players to develop a good shot.<br>Rebounding: Rebounding is the ability to catch the ball after it has been missed by a shooter. It is an important skill for both offense and defense, as it allows teams to get second chances at scoring.<br>Defense: Defense is the ability to prevent the other team from scoring points. It is an essential skill for all basketball players, as it is impossible to win a game without playing good defense. | 10 |
| 3 | **Volley Ball**<br>**History of Volleyball**<br>Volleyball was invented in 1895 by William G. Morgan, a physical education instructor at the Young Men's Christian Association (YMCA) in Holyoke, Massachusetts.<br>Morgan was looking for a game that would be less vigorous than basketball, and he created volleyball as a way to keep his students active during the winter months.<br>The original name of the game was "mintonette," but it was renamed "volleyball" in 1896.<br>Volleyball quickly spread throughout the United States and around the world, and it became an official Olympic sport in 1964.<br>**Fundamental Skills of Volleyball**<br>Passing: Passing is the ability to receive the ball from the opponent and direct it | 10 |

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| | to a teammate. It is an essential skill for all volleyball players, as it allows the team to keep possession of the ball and start an attack.<br>Setting: Setting is the ability to control the height and direction of the ball so that a teammate can spike it. It is a critical skill for setters, as they are responsible for setting up the team's offense.<br>Spiking: Spiking is the ability to hit the ball over the net with power and accuracy. It is the most important skill for scoring points in volleyball, and it is essential for all attackers to develop a good spike.<br>Blocking: Blocking is the ability to prevent the opponent from spiking the ball over the net. It is an important skill for blockers, as they can prevent the other team from scoring points.<br>Digging: Digging is the ability to prevent the opponent from scoring a point by returning the ball over the net. It is an important skill for all defenders, as they are responsible for preventing the other team from scoring points | |
| 4 | **Kabaddi**<br>**History of Kabaddi**<br>Kabaddi is a contact team sport that originated in India.<br>It is believed to have originated in the Indian subcontinent over 4,000 years ago.<br>The game is mentioned in the Sangam literature of Tamil Nadu, which dates back to the 3rd century BC.<br>Kabaddi was first played as a competitive sport in the Indian Olympic Games in 1938.<br>It was included as a demonstration sport at the 1982 Asian Games in Delhi, and it became a full medal sport in the 1990 Asian Games in Beijing.<br>Kabaddi is now played in over 100 countries around the world.<br>**Fundamental Skills of Kabaddi**<br>Dabki: Dabki is the act of entering the opponent's half of the court while chanting "kabaddi, kabaddi." It is a fundamental skill for all raiders, as it allows them to enter the opponent's half of the court without being tackled.<br>Touch: Touching an opponent is the most important skill in kabaddi. It is how raiders score points for their team. There are many different ways to touch an opponent, such as touching their arm, leg, or torso.<br>Tackling: Tackling is the act of preventing a raider from touching an opponent. It is a fundamental skill for all defenders, as it allows them to prevent the other team from scoring points. There are many different ways to tackle a raider, such as grabbing them, pushing them, or tripping them.<br>Stamina: Stamina is essential for all kabaddi players, as the game is very physically demanding. Players need to be able to run, jump, and tackle for long periods of time.<br>Agility: Agility is also important for kabaddi players, as they need to be able to change direction quickly and avoid being tackled. | 08 |
| 5 | **Badminton**<br>**History of Badminton**<br>The game of badminton originated in ancient Greece, China, and India.<br>It was brought to England in the 1870s by British army officers stationed in India.<br>The first badminton club was founded in 1873 at Badminton House, the country estate of the Duke of Beaufort.<br>The first official all-England badminton championships for men were held in 1899, and the first badminton tournament for women was arranged the next | 08 |

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| | year.<br>Badminton became an Olympic sport in 1992.<br>Today, badminton is a popular sport played by millions of people around the world.<br>**Fundamental Skills of Badminton**<br>Grip: The grip is the most important fundamental skill in badminton. It allows you to control the racket and hit the shuttlecock with power and accuracy. There are many different grips, but the most common are the forehand grip and the backhand grip.<br>Footwork: Footwork is essential for moving around the court and positioning yourself to hit the shuttlecock. There are many different footwork drills that you can practice to improve your footwork.<br>Racket control: Racket control is the ability to hit the shuttlecock with power and accuracy. It is important to practice hitting the shuttlecock in different directions and with different levels of power.<br>Timing: Timing is the ability to hit the shuttlecock at the right time. It is important to practice hitting the shuttlecock at the peak of its flight.<br>Stamina: Stamina is essential for badminton, as it is a physically demanding sport. You need to be able to run, jump, and hit the shuttlecock for long periods of time. | |
| 6 | **Soft Tennis**<br>**History of Soft Tennis**<br>Soft tennis is a racquet sport that originated in Japan in the early 20th century.<br>It was created as a less dangerous alternative to lawn tennis, as the ball used in soft tennis is made of foam rubber and does not travel as fast as a regular tennis ball.<br>The first soft tennis tournament was held in Japan in 1921, and the sport quickly spread to other countries in Asia.<br>Soft tennis was first introduced to the United States in the 1950s, and it has since become a popular recreational sport in the country.<br>**Fundamental Skills of Soft Tennis**<br>Grip: The grip is the most important fundamental skill in soft tennis. It allows you to control the racquet and hit the ball with power and accuracy. There are many different grips, but the most common are the forehand grip and the backhand grip.<br>Footwork: Footwork is essential for moving around the court and positioning yourself to hit the ball. There are many different footwork drills that you can practice to improve your footwork.<br>Racket control: Racket control is the ability to hit the ball with power and accuracy. It is important to practice hitting the ball in different directions and with different levels of power.<br>Timing: Timing is the ability to hit the ball at the right time. It is important to practice hitting the ball at the peak of its flight.<br>Stamina: Stamina is essential for soft tennis, as it is a physically demanding sport. You need to be able to run, jump, and hit the ball for long periods of time.<br>**Here are some additional fundamental skills of soft tennis:**<br>Ball control: The ability to control the direction and speed of the ball.<br>Serve: The ability to serve the ball accurately and with power.<br>Volley: The ability to hit the ball before it bounces.<br>Overhead smash: The ability to hit the ball forcefully and accurately overhand. | |

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| | Drop shot: The ability to hit the ball softly and precisely so that it bounces low and close to the net. | |
| 7 | **Tennis**<br>**History of Tennis**<br>The origins of tennis can be traced back to a 12th–13th-century French handball game called jeu de paume ("game of the palm"), from which was derived a complex indoor racket-and-ball game: real tennis.<br>The modern game of lawn tennis was invented in England in the 1870s by Major Walter Wingfield.<br>Wing field created a set of rules and equipment for the game, and he called it "Sphairistike".<br>The game quickly became popular, and it was renamed "lawn tennis" in 1874.<br>The first lawn tennis tournament was held in 1877 at the All England Club in Wimbledon, England.<br>Tennis became an Olympic sport in 1896.<br>Today, tennis is a popular sport played by millions of people around the world.<br>**Fundamental Skills of Tennis**<br>Grip: The grip is the most important fundamental skill in tennis. It allows you to control the racket and hit the ball with power and accuracy. There are many different grips, but the most common are the forehand grip and the backhand grip.<br>Footwork: Footwork is essential for moving around the court and positioning yourself to hit the ball. There are many different footwork drills that you can practice to improve your footwork.<br>Racket control: Racket control is the ability to hit the ball with power and accuracy. It is important to practice hitting the ball in different directions and with different levels of power.<br>Timing: Timing is the ability to hit the ball at the right time. It is important to practice hitting the ball at the peak of its flight.<br>Stamina: Stamina is essential for tennis, as it is a physically demanding sport. You need to be able to run, jump, and hit the ball for long periods of time. | |
| 8 | **Fencing**<br>**History of Fencing**<br>The earliest evidence of fencing dates back to ancient Egypt, Greece, and Rome.<br>Fencing was used as a form of training for warfare and as a way to settle disputes.<br>The modern sport of fencing developed in Italy in the 15th century.<br>The first fencing competition was held in 1550 in Paris.<br>Fencing became an Olympic sport in 1896, and it has been a part of every Game since then.<br>Fencing is now a popular sport all over the world, and there are three main disciplines: foil, épée, and sabre.<br>**Fundamental Skills of Fencing**<br>Footwork: Footwork is essential in fencing, as it allows you to move quickly and efficiently around the piste. There are many different footwork drills that you can practice to improve your footwork.<br>Blade work: Blade work is the ability to use the sword effectively. There are many different blade work techniques, and you need to practice them in order to become proficient. | |

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| | Parrying: Parrying is the ability to deflect an opponent's attack. There are many different parrying techniques, and you need to practice them in order to become proficient.<br>Riposte: The riposte is the counterattack that follows a parry. It is an important skill in fencing, as it allows you to score points.<br>Mental Focus: Mental focus is also an important skill in fencing, as it allows you to stay focused on the opponent and to avoid making mistakes. | |
| 9 | **Athletics**<br>**History of Athletics**<br>The history of athletics can be traced back to the ancient Olympic Games, which were held in Greece from 776 BC to 393 AD.<br>The original events included running, jumping, throwing, and wrestling.<br>The modern Olympic Games were revived in 1896, and athletics has been a part of every Games since then.<br>Athletics is now a global sport, with competitions held at all levels, from local to international.<br>**Fundamental Skills of Athletics**<br>Running: Running is the most basic skill in athletics. It is the ability to move forward quickly and efficiently. There are many different types of running, including sprinting, distance running, and middle-distance running.<br>Jumping: Jumping is the ability to move upwards from the ground. There are many different types of jumping, including high jump, long jump, and triple jump.<br>Throwing: Throwing is the ability to propel an object through the air. There are many different types of throwing, including shot put, discus throw, javelin throw, and hammer throw.<br>Sprinting: Sprinting is a type of running that involves short bursts of speed. Sprinters need to be able to accelerate quickly and maintain their speed for a short period of time.<br>Distance Running: Distance running is a type of running that involves running for long distances. Distance runners need to be able to pace themselves and maintain their energy levels for long periods of time.<br>Middle-Distance Running: Middle-distance running is a type of running that involves running for distances between 800 meters and 1500 meters. Middle-distance runners need to be able to combine speed and endurance.<br>High Jump: High jumping is a type of jumping that involves clearing a bar that is raised progressively higher. High jumpers need to be able to generate a lot of power in their legs and have good timing.<br>Long Jump: Long jumping is a type of jumping that involves jumping as far as possible. Long jumpers need to have good speed and coordination.<br>Triple Jump: Triple jumping is a type of jumping that involves jumping three times in a row. Triple jumpers need to have good speed, coordination, and power.<br>Shot Put: Shot put is a type of throwing that involves throwing a heavy ball as far as possible. Shot putters need to have good upper body strength and technique.<br>Discus Throw: Discus throw is a type of throwing that involves throwing a disc as far as possible. Discus throwers need to have good upper body strength and technique.<br>Javelin Throw: Javelin throw is a type of throwing that involves throwing a | |

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| | spear as far as possible. Javelin throwers need to have good upper body strength and technique.<br>Hammer Throw: Hammer throw is a type of throwing that involves throwing a heavy ball on a chain as far as possible. Hammer throwers need to have good upper body strength and technique. | |
| 10 | **Kho-Kho**<br>**History of Kho-Kho**<br>Kho-Kho is a tag game that originated in India.<br>It is believed to have originated in the Indian subcontinent over 4,000 years ago.<br>The game is mentioned in the Sangam literature of Tamil Nadu, which dates back to the 3rd century BC.<br>Kho-Kho was first played as a competitive sport in the Indian Olympic Games in 1938.<br>It was included as a demonstration sport at the 1982 Asian Games in Delhi, and it became a full medal sport in the 1990 Asian Games in Beijing.<br>Kho-Kho is now played in over 100 countries around the world.<br>**Fundamental Skills of Kho-Kho**<br>Touch: Touching an opponent is the most important skill in Kho-Kho. It is how raiders score points for their team. There are many different ways to touch an opponent, such as touching their arm, leg, or torso.<br>Dive: Diving is a fundamental skill for all Kho-Kho players. It allows players to avoid being touched by the opponents. There are many different types of dives, such as front dive, side dive, and back dive.<br>Stamina: Stamina is essential for all Kho-Kho players, as the game is very physically demanding. Players need to be able to run, jump, and dive for long periods of time.<br>Agility: Agility is also important for Kho-Kho players, as they need to be able to change direction quickly and avoid being touched by the opponents.<br>Teamwork: Teamwork is essential for Kho-Kho, as it is a team sport. Players need to be able to work together to score points and defend their territory. | |
| 11 | **Cricket**<br>**History of Cricket**<br>The history of cricket can be traced back to the 16th century in England.<br>The game is believed to have originated from a game called "stoolball", which was played by children in the 15th century.<br>The first recorded cricket match was played in 1611 between two teams of Kentish cricketers.<br>Cricket became a popular sport in England during the 18th century, and it was first played in Australia in 1826.<br>Cricket became an international sport in the 19th century, and the first Test match was played between England and Australia in 1877.<br>Cricket is now played in over 100 countries around the world.<br>**Fundamental Skills of Cricket**<br>Batting: Batting is the act of hitting the ball with a bat. It is the most important skill in cricket, as it is how runs are scored. There are many different batting techniques, such as the defensive technique and the attacking technique.<br>Bowling: Bowling is the act of delivering the ball to the batsman. There are many different bowling techniques, such as the fast bowling technique and the spin bowling technique.<br>Fielding: Fielding is the act of catching the ball and preventing the batsman | |

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| | from scoring runs. It is an important skill for all cricketers, as it helps to prevent the other team from scoring runs.<br>Running: Running is essential for scoring runs in cricket. Players need to be able to run quickly between the wickets to score runs.<br>Stamina: Stamina is essential for all cricketers, as the game is very physically demanding. Players need to be able to run, jump, and field for long periods of time.<br>Agility: Agility is also important for cricketers, as they need to be able to change direction quickly and avoid being run out.<br>Teamwork: Teamwork is essential for cricket, as it is a team sport. Players need to be able to work together to score runs and prevent the other team from scoring runs. | |
| 12 | **Rifle Shooting**<br>**History of Rifle Shooting**<br>The history of rifle shooting can be traced back to the 16th century in Europe.<br>The first recorded rifle shooting competition was held in 1533 in Zurich, Switzerland.<br>Rifle shooting became a popular sport in Europe during the 18th century, and it was first introduced to the United States in the 1770s.<br>Rifle shooting became an Olympic sport in 1896, and it has been a part of every Games since then.<br>Rifle shooting is now a popular sport all over the world.<br>**Fundamental Skills of Rifle Shooting**<br>Accuracy: Accuracy is the most important skill in rifle shooting. It is the ability to hit the target with the bullet. There are many different factors that affect accuracy, such as the stance, the grip, the breathing, and the trigger control.<br>Consistency: Consistency is also important in rifle shooting. It is the ability to hit the target with the same accuracy shot after shot. There are many different factors that affect consistency, such as the mental focus and the physical preparation.<br>Stance: The stance is the position of the body when shooting. It is important to have a stable stance in order to be accurate. There are many different stances that can be used, such as the standing stance, the kneeling stance, and the prone stance.<br>Grip: The grip is the way that the rifle is held. It is important to have a firm grip in order to be accurate. There are many different grips that can be used, such as the weaver grip and the isosceles grip.<br>Breathing: Breathing is important in rifle shooting because it can affect the accuracy of the shot. It is important to breathe slowly and evenly before and after the shot.<br>Trigger Control: Trigger control is the ability to pull the trigger smoothly and evenly. It is important to avoid jerking the trigger, as this can cause the shot to go off target. | |
| 13 | **Yoga**<br>**History of Yoga**<br>Yoga is a mind and body practice with a 5,000-year history in ancient Indian philosophy.<br>The word "yoga" comes from the Sanskrit word "yuj," which means "to yoke" or "to unite."<br>Yoga is a system of physical postures, breathing exercises, and meditation | |

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| | designed to help practitioners achieve physical, mental, and spiritual well-being. The earliest written records of yoga date back to the 2nd century BCE, and the practice has been evolving ever since.<br>Yoga has spread to all corners of the world, and there are now many different styles of yoga practiced today.<br><br>**Fundamental Skills of Yoga**<br>Postures: The postures, or asanas, are the physical component of yoga. There are many different postures, and they can be practiced in a variety of ways.<br>Breathing: Breathing, or pranayama, is an important part of yoga. There are many different breathing techniques, and they can be used to help relax the body and mind.<br>Meditation: Meditation is the mental component of yoga. There are many different meditation techniques, and they can be used to help focus the mind and achieve a state of peace. | |
| 14 | **Swimming**<br>**History of Swimming**<br>Swimming is one of the oldest sports in the world, with evidence of swimming dating back to 2500 BC.<br>The earliest recorded swimming competitions were held in ancient Greece and Rome.<br>Swimming became an Olympic sport in 1896, and it has been a part of every Game since then.<br>Swimming is now a popular sport all over the world, and there are many different types of swimming, including freestyle, backstroke, breaststroke, butterfly, and individual medley.<br>**Fundamental Skills of Swimming**<br>Breathing: Breathing is one of the most important skills in swimming. It is important to be able to breathe efficiently while swimming in order to avoid getting tired.<br>Body Position: Body position is another important skill in swimming. It is important to maintain a good body position in order to be hydrodynamic and to swim efficiently.<br>Stroke Technique: Stroke technique is the way that the arms and legs are used to propel the body through the water. There are many different stroke techniques, and it is important to develop a good stroke technique in order to swim efficiently.<br>Drills: Drills are exercises that can be used to improve swimming skills. There are many different drills, and they can be used to improve different aspects of swimming, such as breathing, body position, and stroke technique.<br>Mental Toughness: Mental toughness is also an important skill in swimming. It is important to be able to stay focused and motivated during long swims, especially in competitions. | |

## Semester –II

**Course Code:**APS21BSL103 **Course Name:** Linear Algebra and Differential Equations **Course Category: BSC**

**Credits:** 4 **Teaching scheme:** L-4 **Evaluation scheme:** CA–60, ESE–40

**Pre-requisites:** Pre-university mathematics.

**Course Objectives:**

1. This course aims to make the students become familiar with the basic concepts of linear algebra with a thorough understanding of vector spaces, linear transformations and matrix operations enhancing the students' ability to reason mathematically and able to apply this knowledge to many fields in engineering, statistics and computer science.
2. Create and analyze mathematical models using differential equations.

**Course Outcomes:**

On completion of the course, the student should be able to:

1. Understand basic concepts such as vector spaces, linear dependence / independence of vectors, basis and linear maps.
2. Analyze and calculate Eigen values, Eigen vectors, rank nullity of a matrix / linear map.
3. Prove theorems, apply Gram-Schmidt process on inner product spaces, diagonalizable special matrices.
4. Solve ordinary differential equations of first order and apply knowledge of differential of equations to solve engineering problems.
5. Find the solution of linear differential equations having their applications in mechanical and electrical systems.

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Matrices and Vector Spaces:** Basic properties of matrices, row operations and Gauss elimination, Inverse of a matrix. Basic concepts in linear algebra: vector spaces, subspaces, linear independence and dependence of vectors, bases, dimensions. Row and Column spaces, rank. Applications to systems of linear equations, Inverse transformation. | 10 |
| 2 | **Linear mappings and Diagonalization:** Linear mappings, representation by matrices, rank-nullity theorem, Diagonalization, Eigen values, Eigen vectors and their basic properties, Cayley Hamilton Theorem. | 10 |
| 3 | **Inner Product Spaces and Quadratic Forms:** Inner Product Spaces , Orthogonality, Gram-Schmidt process, Geometric Applications of Linear Transformation, Quadratic Forms: Positive Definiteness and applications | 10 |
| 4 | **First order ordinary differential equations and Applications:** Exact , Linear ,Bernoulli and separable differential equations, Applications to Population growth/decay, Mixing problems, Draining tank/Torricelli's Law problems, Newton's Law of Cooling, Electric circuits, Falling bodies. | 10 |
| 5 | **Ordinary differential equations of higher orders and Applications:** Linear differential equations with constant and variable coefficients, method of variation of parameters, Applications to mass spring systems and electrical circuits and Bending of beam and columns. | 10 |

| **Text Books:** |
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| 1. Introduction to Linear Algebra (2nd edition) by Serge Lang, Springer |
| 2. Elementary Linear Algebra (10th edition) by Howard Anton and Chris Rorres, John Wiley and sons. |
| 3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition,Brooks/Cole,2005. |
| 4. S. L. Ross, Differential Equations, 3rd Edition, Wiley India, 1984. |
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| **Reference Books:** |
| 1. Shanti Narayan, Differential Calculus, S. Chand & Co. |
| 2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New York. |
| 3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi. |
| 4. P. N. Wartikar, J. N. Wartikar, Applied Mathematics (Vol I & II) , Pune Vidyarthi Griha Prakashan, Pune. |
| 5. Differential Equations with Applications and Historical notes by George Simmons, Tata McGraw Hill publishing company Ltd, New Delhi |
| 6. K.D Joshi, Calculus for Scientists and Engineers, CRC Press. |
| 7. Prasad and Reena Garg, Advanced Engineering Mathematics, Khanna Publishing Company Private Limited, New Delhi. |
| 8. Schaum's outlines of Linear Algebra (5th edition) by Seymour Lipschutz, Marc Lipson, McGraw-Hill Education (India) Private Limited, New Delhi |

**Course Code:**APS21BSL104 **Course Name:** Engineering Chemistry **Course Category: BSC**

**Credits:**3 **Teaching scheme:** L-3 **Evaluation scheme:** CA–40, MSE-20, ESE–40

**Pre-requisites:** Fundamentals of basic chemistry.

**Course Objectives:**

1. The primary objective of an engineering chemistry course is to familiarize the students with new developments in engineering chemistry.
2. To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.
3. The objectives of the laboratory sessions are to enable the learners to get hands-on experience on the principles discussed in theory sessions and to recognize the applications of these concepts in engineering.

**Course Outcomes:**

At the end of the course, students will be able to,

CO1. Illustrate the water quality parameters, water softening processes and causes of hard water in industries.

CO2. Demonstrate a comprehensive understanding of advanced concepts in polymer chemistry.

CO3. Apply fundamental concepts of corrosion science to solve problems arising in engineering applications.

CO4. Interpret physical, chemical properties and applications of fuels and lubricants.

CO5. Describe the functions of batteries and applications of modern instrumental techniques like Conductometry, pH metry, TLC, gas chromatography, UV-Visible and IR spectroscopy.

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Water Treatment:** Natural sources of water, Impurities in water, Water quality parameters and its BIS standards, Hardness- Definition, Types, Estimation of hardness by EDTA method, Numerical based on hardness calculation, Disadvantages of hard water, Boiler troubles (causes, effect on boiler operation and methods of prevention), Internal and external treatments, Alkalinity and its determination, Water softening: Ion exchange process, Sewage water analysis- Dissolved oxygen (DO) and its determination, Biological oxygen demand (BOD), Chemical oxygen demand (COD) and their significance, Sewage water treatment. | 09 |
| 2 | **Polymer Chemistry:** Introduction, Classification of polymers, Use and disposal of polymers, Polymerization and its types, Plastics and its types- Thermoplastic and thermosetting plastics, Preparation, properties and engineering | 08 |

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| | applications of: PVC, PMMA, Bakelite and Epoxy resin, Moulding constituents of plastics, Methods for moulding of plastics into articles, Conducting polymers and Biopolymers (Introduction, types, examples and its applications. | |
| 3 | **Corrosion and its Control:**<br>Introduction, Types of corrosion, Mechanism of dry & wet corrosion, Factors influencing on corrosion – Nature of metal &Nature of environment. Methods of corrosion control, Cathodic and anodic protection, Use of Inhibitors, Protective Coatings: a) Metallic coatings: Types of coatings methods of applications, (hot dipping, cladding and electroplating), b) Nonmetallic coatings: Chemical conversion coatings, Powder coatings. | 08 |
| 4 | **Fuels and Lubricants:**<br>**Fuels:** Introduction, Classification of fuel, Calorific value of a fuel, Characteristics of a good fuel, Solid fuel- Coal, Various types of Coal, Analysis of coal- Proximate and Ultimate analysis, Numerical based on analysis of coals, Liquid fuel- Refining of Petroleum, Gaseous fuels- LPG and CNG.<br>**Lubricants**: Introduction, Mechanism of lubrication, Classification of lubricants, Solid, Semi-solid and Liquid Lubricants, Properties of lubricants, Physical properties – Viscosity & Viscosity index, Surface tension, Flash and Fire point, Cloud and pour point. Chemical properties – Acid value, Saponification value, Aniline point. | 10 |
| 5 | **Electrochemistry and Instrumental Methods of Chemical Analysis**:<br>**Electrochemistry**: Introduction - Basic concepts: Conductance, Specific Conductance, Equivalent conductance, Molecular conductance, Effect of dilution on conductance, Cell constant. Battery: Primary & secondary batteries, Ni-Cd cell, Lithium-air battery, Fuel cell- $H_2$-$O_2$ Cell.<br>**Instrumental Methods of Chemical Analysis**: Basic principle, instrumentation and applications of pH metry, Conductometry, Thin layer chromatography, Gas Chromatography, Ultraviolet-Visible spectroscopy and Infra-Red Spectroscopy | 10 |

| **Text Books:** |
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| 1. Jain P.C & Jain Monica, Engineering Chemistry, Dhanpat Rai & Sons, Delhi. |
| 2. O. G. Palanna , Engineering Chemistry, Tata McGraw-Hill Publication, New Delhi. |
| 3. S. S. Dara, A textbook of Engineering Chemistry, McGraw-Hill Publication, New Delhi. |
| 4. Shashi Chawla, Engineering Chemistry, Dhanpat Rai and Co Education and Technical Publishers. |
| 5. Shikha Agrawal, Engineering Chemistry- Fundamentals and Applications, Cambridge Publishers |
| |
| **Reference Books:** |
| 1. Barrow G.M., Physical Chemistry, McGraw-Hill Publication, New Delhi. |
| 2. Atkins, Physical Chemistry, OUP Oxford. |
| 3. Bhal & Tuli, Text book of Physical Chemistry, S. Chand & Company, New Delhi. |
| 4. V. R Gowarikar, Polymer Science, New Age International Ltd. |
| 5. B. K. Sharma, Instrumental Methods of Chemical Analysis, Krishna Prakashan Medi |
| |

| **E-Resources:Name of the website/ E-Journals/ Online Videos** |
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| 1. NPTEL Basic Courses Engineering Chemistry (https://nptel.ac.in/courses/122/101/122101001/) |
| 2. https://www.ncertbooks.guru/engineering-chemistry/ |
| 3. Coursera Chemistry Courses (https://www.coursera.org/browse/physical-science-and-engineering/chemistry?languages=en&page=2) |
| 4. "Introduction to Polymer Physics" NPTEL Course (https://www.youtube.com/playlist?list=PLwdnzlV3ogoXe67WsgE8f1fOIWcc5GKKS) |
| 5. "Introduction to Corrosion" NPTEL Course (https://www.youtube.com/playlist?list=PL8lylDWRkaW8BXestE4baRnN0699S11Lq) |
| 6. "Tribology & Lubrication" NPTEL Course (https://www.youtube.com/playlist?list=PLLwnvFq-JAltJvWAfEVU4gcUK27hEA7FD) |
| 7. "Electrochemistry" NPTEL Course (https://www.youtube.com/playlist?list=PLVFqK_9GOGXnnriQpsn0z1Rss96Rh0vsm) |
| 8. "Modern Instrumental Methods of Analysis" NPTEL Course (https://www.youtube.com/playlist?list=PL400CAFBA72E94CF8) |

**Course Code:**APS21ESL103 **Course Name:** Engineering Mechanics **Course Category: ESC**
**Credits:** 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40
**Pre-requisites:**

1. Coordinate Geometry, Trigonometry, Sine & Cosine Rule, Unit Conversions
2. Fundamentals of Physics

**Course Objectives:**

Todevelopcapacitytopredicttheeffectofforceandmotioninthecourseofcarryingout the design functions of engineering.

**Course Outcomes:**

Students are able to,

CO1. Identify the force system forgiven conditions by applying the basics of mechanics.
CO2. Determine the unknown forces of different engineering systems by applying equilibrium conditions.
CO3. Apply the principles of friction and to locate Center of Gravity and find Moment of Inertia of plane lamina.
CO4. Establishtherelationsbetweenkinematicparametersfordifferenttypesofmotion.
CO5. Formulate there levat equations for types of motion in kinetics.

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Force System**: Introduction to Mechanics, Laws of mechanics, Newton's Laws, Law of Parallelogram, Law of transmissibility, Characteristics of force, System of Forces, Method of resolution and composition moment of a force, Law of Moments, Varignon's Theorem, Problem son moment, Resultant, Equivalent force & couple, properties of couple | 08 |
| 2 | **Equilibrium:** Introduction to Equilibrium and its types, Equilibrant, Concept of FBD, Analytical conditions of equilibrium, Equilibrium of different force system, Lami's Theorem, Types of loads, beams and supports. | 07 |
| 3 | **Friction, Centre of Gravity and Moment of Inertia:**<br>**Friction:** Introduction to friction, types and application, Laws of friction, Angle of friction, Angle of repose, Cone of friction, Problems on horizontal & inclined plane, block, and ladder.<br>**CG&MI:** Centroid of regular and composite plane lamina, MI and its application, Perpendicular axis Theorem, Parallel Axis Theorem, Radius of Gyration, Problems on plane and composite lamina. | 08 |
| 4 | **Kinematics:** Introduction and classification of dynamics, motionanditsclassification,RectilinearMotion,EquationofMotion,Motioncurves,CurvilinearMotion,rectangularandtangentialcomponentsofacceleration,ProjectileMotion:GeneralEquation of Projectile Motion | 04 |
| 5 | **Kinetics**: Basic Concepts And laws of motion, D' Alembert's Principle, Problems on rectilinear motion, Curvilinear motion, Work Energy | 03 |

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| | Principle, Work Done by force, Work Done by weight force, Work Done by frictional force, Work Done by spring force, Kinetic and Potential energy of the particle, Problemsonal cases of Work Done, Principle of Impulse and Momentum, Principle of Conservation Momentum, Impact and its types, Co efficient of restitution, Problems on impact, Problems on impulse and momentum, Kinetics of rigid body problems. | |

| **Text Books:** |
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| 1. Beer,F.PandJohnstonJr.E.R.,"VectorMechanicsforEngineers(InSIUnits):StaticsandDynamics",8thEdition,TataMcGraw-HillPublishingcompany,NewDelhi(2004). |
| 2. Vela Murali, "Engineering Mechanics", Oxford University Press(2010). |
| 3. S.Timoshenko,D.H.Young,"EngineeringMechanics",McGrawHill,1995. |
| 4. TayalA.K.,"EngineeringMechanics",UmeshPublications,2010. |
| 5. SingerF.L.,"EngineeringMechanics-Statics&Dynamics",HarperandRowPub.York. |
| 6. Khurmi R. S. ,"Engineering Mechanics", S. Chand Publications N. Delhi. |
| |
| **Reference Books:** |
| 1. McLean,Nelson,"EngineeringMechanics",Schaum'soutlineSeries,McGrawHillBookCompany,N.Delhi,Publication. |
| 2. Hibbeller,R.CandAshokGupta,"EngineeringMechanics:StaticsandDynamics",11thEdition, PearsonEducation(2010). |
| 3. Bhavikatti,S.SandRajashekarappa,K.G.,"EngineeringMechanics",NewAgeInternational(P) LimitedPublishers,(1998). |
| 4. Irving H. Shames and Krishna MohanaRao.G.,"EngineeringMechanics– StaticsandDynamics",4thEdition,PearsonEducation(2006). |
| 5. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Staticsand Dynamics",3rdEdition,Vikas Publishing House Pvt.Ltd., (2005). |
| 6. MeriamJ.L.andKraigeL.G.,"EngineeringMechanics-Statics-Volume1,Dynamics-Volume2",ThirdEdition,JohnWiley& Sons,(1993). |
| |
| **General Instructions:** |
| **E-Resources:** |
| 1. www.nptel.ac.in(LearningplatformfromIITprofessors) |
| 2. http://www.asnu.com.au(ForEngineeringapplications) |
| 3. www.discoveryforengineers.com(InvestigatingDiscoveries) |

**Course Code:**APS21ESL104 **Course Name:** Building Programming logic in C **Course Category:** ESC

**Credits:**1 **Teaching scheme:** L-1 **Evaluation scheme:** CA–30, ESE–20

**Pre-requisites:** Pre-university mathematics.

**Course Objectives:**

1. The primary objective of an engineering chemistry course is to familiarize the students with new developments in engineering chemistry.
2. To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.
3. The objectives of the laboratory sessions are to enable the learners to get hands-on experience on the principles discussed in theory sessions and to recognize the applications of these concepts in engineering.

**Course Outcomes:**

After the completion of this course, students will be able to:

CO1: Illustrate and explain the basic computer concepts and programming principles of C language.

CO2: Develop C programs to solve simple mathematical and decision making problems.

CO3: Develop C programs to solve simple engineering problems using looping constructs.

CO4: Develop C programs to demonstrate the applications of derived data types such as arrays, pointers, strings and functions.



**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Introduction To C Programming:**<br>**Fundamentals of C Programming: Overview of C:** History of'C, Algorithm and Structure of C program. Keywords, Tokens, Data types, Constants, Literals and Variables.<br>**Operators and Expressions:** Arithmetic operators, Relational operator, Logical operators, Expressions, Operator: operator precedence and associatively, Type casting, Console FO formatting, Unformatted I/O functions: getch(), getchar, getche(), getc(), putc(), putchar(). | 03 |
| 2 | **Array and String:**<br>**Control statements:** If-else, conditional operators, switch and break, nested conditional branching statements, loops: do while, while, for, Nested loops, break and continue, goto and label, exit function.<br>**Array:** Array declaration, One and Two dimensional numeric and character arrays, Multidimensional arrays, operations on array.<br>**String:** String declaration, initialization, string manipulation with/without using library function. | 03 |
| 3 | **Control Statements and Functions:**<br>**Functions:** Definition, function components: Function arguments, return value, function call statement, function prototype, Types of function, Scope | 03 |

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| | and lifetime of variable, Call by value,and call by reference. Function using arrays, function with command line argument. User defined function: maths and character functions, Recursive function. | |
| 4 | **Structure and Union:**<br>**Structure:** Basics, declaring structure and structure variable, typedef statement, array of structure, array within structure, Nested structure; passing structure to function, function returning structure.<br>**Union:** basics, declaring union and union variable, Difference between Structure and Union<br>**Enum:** declaring enum and enum variable. | 03 |
| 5 | **Pointers**: **Pointer:**<br>Definition of pointer, advantage and disadvantage using pointer, Pointer declaration, Using & and * operators. Void pointer, Pointer to pointer, Pointer in math expression, Pointer arithmetic, Pointer comparison, **Dynamic memory allocation functions**: malloc, calloc, realloc and free, Pointer vs. Array, Array of pointer, Pointer to array, Pointers to function, Function returning pointer, Passing function as Argument to function, Pointer to structure, Dynamic array of structure through pointer to structure. | 03 |

| **Text Books:** |
|---|
| 1. Programming in ANSI C, E Balagurusamy, Tata McGraw-Hill, Third Edition. |
| 2. Let Us C, Yashwant Kanetkar, Infinity Science Press, Eighth Edition. |
| 3. Mastering C, K R Venugopa1, Tata McGraw-Hill. |
| |
| **Reference Books:** |
| 1. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, Prentice Hall, 2nd Edition. 5. Applications Programming in ANSI C, R. Johnson Baugh , Martin Kalin, Macmillan, 2nd Edition. |
| 2. The Spirit of C, Mullish Cooper, Jaico publishing House. |
| 3. How to solve it by Computer, R. G. Dromey, Pearson Education. |

**Course Code:**APS21PCL101 **Course Name:** Basics of Electrical and Electronics Engineering **Course Category:** PCC

**Credits:**2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40

**Pre-requisites:** Pre-university mathematics.

**Course Objectives:**

1. Understand Electrical circuits and classify circuit sasper laws.
2. Understand Magnetic circuits and apply them intrans for merdevices.
3. Understand the working principle of semiconductor devices.
4. Understand the basics and applications of digital electronics.

**Course Outcomes:**

After completion of this course, students will be able to:

1. Solve simple D C and single-phase A C circuits using KCL, KVL and network theorems.
2. Explain fundamentals of magnetic circuit and transformers.
3. Explain the working of diodes and transistors.
4. Explain the importance of number systems and logic gates.



**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Electrical Circuits:** Voltage and current sources: independent, dependent, ideal and practical; V-I relationships of resistor, inductor, mutual inductor and capacitor; Kirchhoff's laws, mesh and nodal analysis, superposition, The venin's, maximum power transfer theorems. Alternating voltages and currents, RMS, average, maximum values, Single Phase RL, RC, RLC series circuits, Power in AC circuits, Power Factor, Three phase balanced systems. | 08 |
| 2 | **Magnetic Circuits & Transformer:** Concepts of m.m.f, flux, flux density, reluctance, permeability and field strength, their units and relationship, right hand thumb rule and corkscrew rule, Faraday's law of electromagnetic induction, Fleming's right-hand rule, statically and dynamically induced EMF' ssel fandmutual inductance co efficient of coupling, energy stored in magnetic circuit, Single phase transformers: Construction, principle of working, e.m.f. equations. | 08 |
| 3 | **Semiconductor Devices:** Introduction to Semiconductors, P-type and N-type Semiconductors, P-N Junction Diode: Construction and working, V-I characteristics of Diode, Reverse break down mechanism. Special purpose diodes: Zener Diode, Light Emitting Diode(LED) and Photo Diode -Construction, working and applications. Bipolar Junction Transistor (BJT): types, construction and regions | 07 |

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|---|---|---|
| | of operation. | |
| 4 | **Digital Electronics:**<br>Binary, Decimal, Octal, Hexadecimal number systems and their inter-conversion, Binary Addition, Binary Subtraction, One's complement, Two's complement, Logic Gates: Basic, Universal and Special. Boolean Laws (AND, OR, NOT) and Demorgan's theorems, Realization of basic logic gates using universal gates. | 07 |

| **TEXTBOOKS:** |
|---|
| |
| 1. V.N.MittalandArvindMittal,"BasicElectricalEngineering"McGrawHill |
| 2. Edward Hughes," Electrical Technology,", Pearson Education |
| 3. ElectricalTechnologyVol.1& Vol.4byB.L. Theraja & A. K. Theraja, S. Chand Publications |
| 4. "Principles of Electronics", V. K. Mehta, S. Chand Publications. |
| 5. "Electronics Devices and Circuits", S Salivahanan, McGraw Hill Publications. |
| |
| **REFERENCEBOOKS:** |
| 1. VincentDelToro,"ElectricalengineeringFundamentals",PHIsecondedition2011 |
| 2. RobertBoylestad,"ElectronicsDevicesandCircuitsTheory",PearsonEducation India |
| 3. "Electronics Devices and Circuits Theory", Robert Boylestad, Pearson Education India. |
| |
| **E-Resources:** |
| 1. Online course on NPTEL "Basic Electrical Engineering" |
| 2. NPTEL Course on "Introduction to Basic Electronics", Prof. T.S. Natarajan, IIT Madras. |
| 3. NPTEL Course on "Digital Electronic Circuits", Prof. Goutam Saha, IIT Kharagpur. |

**Course Code:** APS21IKL101 **Course Name:** Indian Knowledge Systems **Course Category:** IKS

**Credits:**2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40

**Pre-requisites:** Nil

**Course Objectives:**

The objective of this course is

1. To make students understand foundational concepts in IKS for science, engineering and technology.
2. To explore ancient Indian pursuits and accomplishments in the various domains of engineering

**Course Outcomes:**

On completion of the course, the student should be able to:

CO 1: familiarize with key components of the IKS & develop appreciation for Indian philosophical systems.

CO 2: understand key features of Indian Numeral System, units of measurement and the framework for establishing the right knowledge.

CO 3: appreciate the unique & specific contributions of ancient Indian mathematicians in Arithmetic, Geometry & Trigonometry.

CO 4: develop awareness about engineering & technology heritage of India and understand ancient Indian contributions in various engineering domains.



**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Introduction to IKS:** Importance of ancient knowledge, defining IKS, Classification framework for IKS, Historicity of IKS, Indian philosophical systems, Vedic schools of philosophy ( Sankhy and yoga, Nyaya and Vaisesika, Purva- Mimamsa and Vedanta), Non- Vedic philosophical systems (Jain, Bauddha and Carvaka) , Wisdom through the ages: Issues of interest in the Puranas, Itihasa as a source of wisdom (Uniqueness of the two epics), Nitisastras. | 08 |
| 2 | **Foundational Concepts for Science and Technology:** Number system in India, salient features of the Indian numeral system, Measurements for Time, Distance and weight, The knowledge triangle, Prameya- a Vaisesikan approach to Physical Reality, Pramana – The means of valid knowledge, Framework for establishing valid knowledge. | 07 |
| 3 | **Science in IKS:** Mathematics: Great mathematicians and their contributions, Arithmetic (square of a number, square root, series and progressions), Geometry ( | 07 |

| | | |
|---|---|---|
| | Property of right angled triangle in Sulba- sutras, value of π), Trigonometry, Algebra, Binary Mathematics and combinatorial problems in Chandah-Sastra of Pingala | |
| 4 | **Engineering and Technology in IKS:**<br>The Indian Science and Technology Heritage, Mining and ore extraction, Metals and metal working technology, Iron and Steel in India, Lost wax casting of idols and artifacts, apparatuses used for extraction of metallic components.<br>Literary sources for Science and Technology, Physical Structures in India, Irrigation & Water Management, Dyes and Painting Technology, Shipbuilding. | 08 |

| **Textbooks:** |
|---|
| ● Mahadevan B., Bhat Vinayak Rajat & Nagendra Pavana R.N. "Introduction to Indian Knowledge System Concepts and Applications" PHI,2023. |
| ● Jha Amit "Traditional Knowledge System in India" Atlantic Publishers and Distributors (P) Ltd,2023 |
| ● Chauhan Bhag Chand "IKS: The Knowledge system of Bharata" Garuda Prakashan,2023 |
| ● Bag A.K., "Mathematics in Ancient and Medieval India" Chaukhambha Orientalia, 1979 |
| ● Sengupta Nirmal,"Traditional Knowledge in Modern India"Springer,2019 |
| |
| **Reference Books:** |
| ● Bag A.K., "History of Technology in India, Vol. I" Indian National Science Academy,1997 |
| ● Kumar Alok, "Ancient Hindu Science" Jaico Publishing House,2019 |
| ● Datta B and Singh A.N."History of Hindu Mathematics:Parts I and II" Asia Publishing House,1962 |
| ● Kapoor Kapil, Singh Awdhesh Kumar "Indian Knowledge Systems Vol.-I & II" D.K. Print World Ltd,2005 |
| |
| **E-Resources:** |
| • https://www.youtube.com/watch?v=-cBd6JYPWtY&list=PLRfu94TCePTtWtu0x145H_63WgoeYickE |
| • https://www.youtube.com/watch?v=yvj5ROYbP2E&list=PLRfu94TCePTtLuEYSzmJXNYK_EnDSvY3N |
| • https://iksindia.org/book-list.php |

**Course Code:**APS21VSP102 **Course Name:** Workshop Practices **Course Category:**VSEC

**Credits:**2 **Teaching scheme:** L-4 **Evaluation scheme:** CA–60, ESE–40

**Pre-requisites:** Pre-university English.

**Course Objectives:**

1. To know about the different carpentry tools and perform various carpentry operations to complete the job.
2. To understand different welding tools, joints, defects and perform welding operation to complete useful article/job.
3. To learn various types of pipes, plumbing tools, operations and perform thread cutting on GI pipes.
4. To know different sheet metal tools, operations, applications and perform various operations to complete job.

**Course Outcomes:**

On completion of the course, the student should be able to:

1. Perform basic carpentry operation on wood and prepare carpentry article.
2. Perform welding processes and prepare welding article by performing various welding operations.
3. Use plumbing tools, processes and perform threading on GI pipe.
4. Use sheet metal tools, processes and prepare sheet metal article.

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Carpentry Shop:**<br>Carpentry shop: Types of woods, tools, joints, operations, applications, safety measures etc.<br>Job: Exercises on wood involving operations marking, sawing, chiseling, planning, grooving etc to make useful wooden article/ job e.g. Wooden Trophies, Showpiece articles, Stools etc. | 08 |
| 2 | **Welding Shop:**<br>Welding Shop: Types of welding, welding joints, tools, welding defects, applications, safety measures etc.<br>Job: Exercise in Arc welding to make useful articles like Grills, Stools, Tree Guards, Flower pot stand, Shoe rack, Bag Stand, Showpiece Articles from Scrap etc. | 07 |

| | | |
|---|---|---|
| 3 | **Plumbing Shop:**<br>Plumbing shop: Study of types of pipe, pipe joints, operations, applications, safety measures etc.<br>Job: Prepare threading on GI pipe to make useful items like Nipple, Pipe joints etc. | 07 |
| 4 | **Sheet Metal Shop:**<br>Sheet Metal Shop: Sheet metal tools, operations, applications, safety measures etc.<br>Job: Making an utility item using G I sheet involving development, marking, cutting , bending, spot welding/riveting Parts like i) Tray, ii) Funnel etc. | 08 |

- **Term work:** Students shall maintain workshop diary which contains Job Drawing, information of tools, operations required to complete the jobs, records of job completions etc.
- **End Semester Exam:** ESE will be viva-voce based on jobs prepared by the students during the term.

**Text Books:**

1. Hazra and Choudhary, Workshop Technology-I, Media promoters & Publisher private limited.
2. Hazra and Choudhary, Workshop Technology-II, Media promoters & Publisher private limited.

**Reference Books:**

1. K. C. John, Mechanical Workshop Practice, Prentice Hall Publication, New Delhi, 2010.

**Course Code:** APS21BSP102 **Course Name:** Engineering Chemistry Lab **Course Category:** BSC
**Credits:** 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20
**Pre-requisites:** Nil

**Course Objectives:**

**Course Outcomes: Upon completion of the Lab Experiments, the students should able to,**

LO1 Perform the experiments as well as accurately record the readings and analyze the results of such experiments.

LO2 Estimate the impurities present in water using titri metric and instrumental methods.

LO3 Employ the basic techniques used in chemistry laboratory for analysis such as volumetric titrations, complex metric titrations, Conductometry, pH metry, viscometer, Stalagmometer and TLC

**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | Determination of hardness of water sample by EDTA method. | 02 |
| 2 | Determination of chloride content in water sample by precipitation titration method. | 02 |
| 3 | Determination of dissolved oxygen in water by Iodometric method. | 02 |
| 4 | Determination of percentage purity of bleaching powder. | 02 |
| 5 | Determination of strength of acid / base using pH metric titration. | 02 |
| 6 | Determination of strength of acid / base using Conductometry titration. | 02 |
| 7 | To determine the cell constant of the given conductivity cell. | 02 |
| 8 | To determine relative surface tension of unknown liquids by using Stalagmometer. | 02 |
| 9 | To determine the viscosity of unknown liquids by using Ostwald / Redwood viscometer. | 02 |
| 10 | To determine acidity of given water sample. | 02 |
| 11 | Determination of acid value of an oil sample. | 02 |
| 12 | Determination of Saponification number of an oil sample. | 02 |
| 13 | To determine alkalinity of given water sample. | 02 |
| 14 | Preparation of phenol- formaldehyde / urea-formaldehyde resin. | 02 |
| 15 | To find out the Rf value of given sample by thin layer chromatography. | 02 |
| 16 | To separate the given mixture using thin layer chromatography. | 02 |
| 17 | Proximate analysis of coal (moisture content, volatile matter, ash content). | 02 |
| 18 | To study factors influencing on rate of electrochemical corrosion. | 02 |
| 19 | To determine flash and fire point of given oil by Pesky-Marten flash point apparatus. | 02 |
| 20 | To determine cloud and pour point of lubricating oil. | 02 |

**Reference Books:**

1. A Text book on Experiments and Calculations in Engineering Chemistry by Dr. S. S. Dara, S Chand Publication.
2. Laboratory manual on Engineering Chemistry by S. K. Bhasin & Sudha Rani, Dhanpat Rai Publishing Company.
3. Engineering Chemistry with Laboratory Experiments by M. S. Kaurav, Asia-Pacific the holdings Private Ltd.

**Course Code:**APS21ESP104 **Course Name:** Engineering Mechanics lab **Course Category:** ESC

**Credits:** 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20

**Pre-requisites:** Nil

**Course Objectives:**

**Course Outcomes:**

**Upon completion of the Lab Experiments, the students should able to,**

1. Describe the working principle of mechanics and correlate them with day to day engineering applications.
2. Formulate and solve mechanics problems based on law of moments, conditions of equilibrium.
3. Verify theoretical concepts through analytical, experimental and graphical methods.

**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | Verification of law of Machine using Screw jack | 02 |
| 2 | Polygon law of coplanar forces. | 02 |
| 3 | Bell crank lever | 02 |
| 4 | Lami's Theorem | 02 |
| 5 | Support reactions for beam | 02 |
| 6 | Problems on beam reaction by graphics statics method | 02 |
| 7 | Inclined plane (to determine coefficient of friction). | 02 |
| 8 | Centroid of irregular shaped bodies | 02 |
| 9 | Determine center of gravity for composite sections | 02 |
| 10 | Determine moment of inertia for composite sections | 02 |
| 11 | Moment of Inertia of fly wheel | 02 |
| 12 | Simple / compound pendulum | 02 |

**References:**

1. "College of Engineering, Pune"
2. "University of Mumbai"

**Course Code:** APS21ESP105 **Course Name:** Building Programming logic in C-LAB **Course Category:** ESC

**Credits:** 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20

**Pre-requisites:** Nil

**Course Objectives:** Nil

**Course Outcomes:** Nil

**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | a) Write a C program to find sum and average of three numbers.<br>b) Write a C program to find the sum of individual digits of a given positive integer. | 02 |
| 2 | a) Write a C program to generate the first n terms of the Fibonacci sequence<br>b) Write a C program to generate prime numbers between 1 to n.<br>c) Write a C program to check if the given number is Armstrong or not | 02 |
| 3 | a) Write a C program to check whether the given number is perfect or not<br>b) Write a C program to check whether the given number is strong or not | 02 |
| 4 | a) Write a C program to find the roots of a quadratic equation.<br>b) Write a C program perform arithmetic operations using switch statement. | 02 |
| 5 | a) Write a C program to find factorial of a given integer using non-recursive function<br>b) Write a C program to find factorial of a given integer using recursive function | 02 |
| 6 | a) Write C program to find GCD of two integers by using recursive function.<br>b) Write C program to find GCD of two integers by using non-recursive function. | 02 |
| 7 | a) Write a C program to find the largest and smallest number in a list of integers.<br>b) Write a C program to Sort the Array in an Ascending Order.<br>c) Write a C program to find whether the given matrix is symmetric or not. | 02 |
| 8 | a) Write a C program to perform addition of two matrices.<br>b) Write a C program using function to perform multiplication of two matrices. | 02 |
| 9 | a) Write a c program to use function to insert a sub-string in to given main string from a given position.<br>b) Write a c program to swap the values of two variables using<br>(i) call by value (ii) call by reference | 02 |
| 10 | a) Write a C program using user-defined functions to determine whether the given string is palindrome or not.<br>b) Write a C program that displays the position or index in the main string S where the sub string T begins, or - 1 if S doesn't contain T. | 02 |
| 11 | a) Write C program to count the number of lines, words and characters in a given text.<br>b) Write a C program to find the sum of integer array elements using pointers. | 02 |
| 12 | a) Write a C Program to Calculate Total and Percentage marks of a student using structure. | 02 |

**Course Code:**APS21PCP101 **Course Name:** Electrical and Electronics Technology Lab **Course Category:** PCC

**Credits:** 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20

**Pre-requisites:** Nil

**Course Objectives:**

1. Understand the DC circuit as per KCL & KVL and AC circuits as per theorems.
2. Understand the working of a single-phase transformer.
3. Understand the working of electronic instruments, components and logic gates.
4. Understand the working of a PN junction diode.

**Course Outcomes:**

After completion of this lab, students will be able to:

1. Use of KCL&KVL to solve D C circuits as well as use of AC theorems to solve AC circuits.
2. Demonstrate a single-phase transformer & it's working.
3. Use electronic instruments, working of electronic components and logics gates.
4. Use of P N Junction Diode and its applications.

**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | Verification of Loop Analysis and Nodal Analysis for DC Circuits. | 02 |
| 2 | Verification of The venin's Theorem for DC Circuits. | 02 |
| 3 | Verification of Maximum Power Transfer Theorem for DC Circuits. | 02 |
| 4 | Determination of Voltage, Current and Power Flow in Single Phase AC Circuit including R, L and C with Combination. | 02 |
| 5 | Determination of Magnetic Material Terms and EMF Induction. | 02 |
| 6 | Demonstration and Determination of Single-Phase Transformer Terms like Voltage Ratio and Turns Ratio. | 02 |
| 7 | Study of Electronic Instruments. | 02 |
| 8 | Study of Electronic Components. | 02 |
| 9 | Study of Logic Gates. | 02 |
| 10 | Study of V-I characteristics of a PN Junction Diode using V-Lab. | 02 |
| 11 | Study of Rectifier Circuits using Every Circuits emulation application. | 02 |
| 12 | Study of working and troubleshooting of Smartphone, Computer & TV (Case Study Approach). | 02 |

**Course Code:** MGM82CCP104 **Course Name:** National Service Scheme (NSS) **Course Category:** CCA

**Credits:** 2 **Teaching scheme:** P-4 **Evaluation scheme:** CA-50, ESE-0

**Pre-requisites:** Nil

**Course Objectives:** Nil

**Course Outcomes:** Nil

**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | **Introduction to National Service Scheme(NSS):**<br>**Emergence of NSS in India (Historical Background ) and its development.**<br>Organizational Structure of National Service Scheme from National Level to College Level. Objectives of National Service Scheme(NSS) National Service Scheme(NSS)–Symbol and its meaning<br>**Symbol of NSS and its meaning**<br>Motto of National Service Scheme (NSS)<br>Various prayers, inspirational songs to be used in NSS Programme. | 08 |
| 2 | **National Service Scheme (NSS) Regular Activities:**<br>**Guidelines of Distribution of working hours or academic year.**<br>**Classification of Regular Activities in the Society**<br>• Rural<br>• Urban<br>• Campus<br>• Need base with association<br>**Associations in NSS Activities**<br>• Govt. Organization<br>• NGO<br>Scope for Innovation (Self-Generated) | 08 |
| 3 | **Social Issues in India:**<br>**Concept of Society, Community (Steps in volve dine valuation of society)**<br>• Features of Indian Society<br>• Communities in India<br>**Basic Social Issues in India**<br>Family System, Division of labour, Cast System in India, Gender Issues, Regional Imbalance | 07 |
| 4 | **Indian Constitution and Social Justice:**<br>**Indian Constitution** | 07 |

| | | |
|---|---|---|
| | • Preamble<br>• Structure<br>• Features<br>• Fundamental Rights & Duties<br>**Social Justice**<br>• Social Justice – the Concept and its features<br>Contribution for Social Justice – Mahatma Jyotiba Phule, Dr. Babasaheb Ambedkar, Shahu Maharaj. | |

**References:**

1. National Service Scheme Manual (Revised) 2006, Government of India, Ministry of Youth Affairs and Sports, New Delhi.
2. University of Mumbai National Service Scheme Manual 2009
3. Avhan Chancellor's Brigade-NSS Wing, Training camp on Disaster Preparedness Guidelines, March 2012.
4. Rashtriya Seva Yojana Sankalpana- Prof. Dr. Sankay Chakane, Dr. Pramod Pabrekar, Diamond Publication, Pune.
5. National Service Scheme Manual for NSS District Coordinators, National Service Scheme Cell, Dept. of Higher and Technical Education, Mantralaya,
6. Annual report of National Service Scheme (NSS) published by Dept. of Higher and Technical Education, Mantralaya,
7. NSS Cell, Dept. of Higher and Technical Education, Mantralaya, UTKARSHA- Socio and cultural guidelines.

| | | |
|---|---|---|
| **Course Code:**MGM73CCP105 | **Course Name:** Fine Art | **Course Category:** CCA |
| **Credits:** 2 | **Teaching scheme:** P-4 | **Evaluation scheme:**CA-50, ESE-0 |
| **Pre-requisites:** Nil | | |

**Course Objectives:**

The objective of this course is

- Students will be able to draw clean lines.
- Students will be able to explore shading from light to dark.
- Students will be able to draw perspective drawing.
- Students will be able to sketch landscape and portrait drawing.

**Course Outcomes:**

On completion of the course, the student should be able to:

- Students will be able to pay attention to core details in visualization.
- Students will be able to represent on paper what they have observed in terms of 3 and 2 dimensional objects and light and dark play of perspective.
- Students will be able to draw clean lines and neat figures which will gradually help them in fashion illustrations.

**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | **Introduction to Drawing:**<br>• Explore pencil as medium for drawing and exploration of different types of grade of pencils.<br>• Lines – Freeing hand movement by practicing various ways to draw lines (wavy/zigzag/diagonal/vertical/horizontal) | 08 |
| 2 | **3D objects with Shading:**<br>• Exploring and sketching 3D objects with Shading/Hatching – Light to Dark (HB/2B/3B/4B/5B/6B)<br>• Space Division – Studying of proportion, Perspectives- Coin / Box / Landscape. | 07 |
| 3 | **Sill Drawing:**<br>• Introduction to landscape and portrait drawing.<br>• Still drawing (perspective drawing of man- made object) | 07 |
| 4 | **Exploration of colour mediums:**<br>• Exploration of color mediums (chalk/ink/poster/pastels/water)<br>• Landscape perspective of natural and man- made, charcoal rendering.<br>• Still drawing of man- made and natural object by rendering and defining Perspective. Ambedkar, Shahu Maharaj. | 08 |

**Reference Books:**


- Mellem, Jeff; Sketching people & Live drawing basics.
- Belleville- Van Stone, France; Sketch: the Non-Artist's guide to inspiration

**Course Code:** MGM73CCP106 **Course Name:** Visual Art **Course Category:** CCA

**Credits:** 2 **Teaching scheme:** P-4 **Evaluation scheme:**CA-50, ESE-0

**Pre-requisites:** Nil

**Course Objectives:**

The objective of this course is

- To understand the actual work process in advertising market.
- To understand the growth and necessity of advertising in market.

**Course Outcomes:**

On completion of the course, the student should be able to:

- Students will be able to choose a topic for campaign design.
- Students will understand that how campaign design is necessary
- Student will understand the actual work process in advertising market.
- Student will understand the process of designing.

**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | **Introduction to Campaign Design:**<br>• Topic for campaign design<br>• It should be either product, service or social topic.<br>• Mind mapping | 08 |
| 2 | **Media:**<br>• Different types of media<br>• New digital medias<br>• Use of elective subject in campaign<br>• Software use in designing | 11 |
| 3 | **Sill Drawing:**<br>• Final layout<br>• Printing in actual size media<br>• Presentation on ppt of the topic includes artwork with rough work. | 11 |

**Reference Books:**

- Advertising Campaign Design Just the Essentials - By Robyn Blackman
- Campaign Strategies and Message Design: A Practitioner's Guide from Start to Finish - by Mary Moffitt (Author)
- Student should refer the previous knowledge about medias and refer the internet for help.

**SEMESTER-III**

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|---|
| **Course Code:** BIC26PCL201 **Course Name:** Sensors and Transducers **Course Category:** PCC<br>**Credits:** 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40<br>**Duration:** 2 h<br>**Pre-requisites:** Basic of electronics and electrical |
| **Course Objectives:**<br>1.To understand fundamental concepts of sensors and Transducers<br>2.To learn the different Measurements<br>3.To understand various environmental sensors |
| **Course Outcomes:**<br>CO1**:** To understand various sensors used in temperature measurement<br>CO2: To explain working principle various pressure sensors<br>CO3: Explain design criteria of flow measurement<br>CO4: Apply various sensors knowledge |

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Temperature Measurement:** Introduction to sensors and its characteristics**,** selection criteria, standards and calibration, data acquisition, Importance of sensing and its use in data analytics, Temperature scales, classification of temperature sensors, standards, working principle, types, materials, Non electrical sensors (thermometer, thermostat), electrical sensors (RTD thermocouple, Thermistor, radiation sensors (pyrometers Lies t various standards used for selection of transducers/sensors). | 8 |
| 2 | **Pressure and Level Measurement:** Definition pressure scale, standards, working principle, types, materials, elastic pressure sensors, secondary pressure sensors, differential pressure sensors, capacitive (delta cell), high-pressure sensors, low-pressure sensors, standards, working principle, types, materials, design criteria: float, displacers, bubbler, ultrasonic, microwave, radar, resistance, thermal, solid level detectors | 8 |
| 3 | **Flow Measurement:** Standards, working principle, types, materials, and design criterion: primary or quantity meters (positive displacement flow meter), secondary or rate meter (obstruction type, variable area type), electrical flow sensors (turbine type, electromagnetic type, and ultrasonic type), flow switches | 7 |
| 4 | **Environmental sensors:** pH sensors, Conductivity sensors, Humidity, turbidity, dissolved oxygen (DO) sensor, Biochemical oxygen demand (BOD) sensor, total dissolved oxygen (DO) sensor, Chemical Oxygen Demand (COD) sensor: working principles, types and applications | 7 |

| | | |
|---|---|---|
| | flame sensor, smoke sensor, motion sensor, leak detector, density, Viscosity: working principles, types and applications. Smart sensors, MEMS, Nano sensors, semiconductor sensors, biosensors: Introduction and applications | |

| **Text Books:** |
|---|
| 1. D.V.S. Murthi, "Instrumentation and Measurement Principles", PHI, New Delhi, Second ed. 2003 |
| 2. D. Patranabis, "Principle of Industrial Instrumentation", Tata McGraw Hill, Second ed., 1999 |
| 3. R.S, Khandpur, "Handbook of Analytical Instruments", Tata McGraw Hill Education, third edition., 2017 |
| 4. R. Frank, "Understanding SmartSensors",Artechhouse,secondedition,2000. |
| |
| **Reference Books:** |
| 1. B.G. Liptak, "Process Measurement & Analysis", Chilton Book Company, Fourthed., 2003. |
| 2. E.O. Doebelin, "Measurement Systems", McGraw Hill, Fifthed., 2003. |
| 3. SabrieSoloman,"SensorsHandbook",McGrawHillPublication,Firsted.,1998. |
| 4. A. K. Sawhney, "Electrical & Electronic Instruments & Measurement", Dhanpat Rai and Sons, Eleventh ed., 2000. |
| 5. R.K.Jain,"EngineeringMetrology",KhannaPublisher,Delhi,Eighteenthed.,2002. |
| PaulChapman,"SmartSensors"ISAseries,199 |
| |
| **E-Resources:** |
| 1. www.nptel.ac.in (Learning platform from IIT profe**ssors)** |
| 2. **nptel.ac.in/courses/103101142** |
| 3. www.discoveryforengineers.com (Investigating Discoveries) |

**Course Code:** BIC26PCL202 **Course Name:** Control System **Course Category:** PCC
**Credits:** 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40
**Duration:** 2h
**Pre-requisites :** Fundamentals of accounting and finance

**Objectives :**

1. To study electrical and mechanical system
2. To study system response

**Course Outcomes:**

At the end of the course, the students will be able to -

**CO1**. Develop mathematical model of Electrical and Mechanical system using differential equations and transfer function and develop analogy between Electrical and Mechanical systems.

**CO2**. Determine time response of systems for a given input and perform analysis of first and second order systems using time domain specifications.

**CO3**. Investigate closed loop stability of system in s-plane using Routh Hurwitz stability criteria and root locus.

**CO4.** Analyze the systems in frequency domain and investigate stability using Nyquist plot and Bode plot

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Basics of Control System**: Basic concepts of control system, classification of control systems, types of control system: feedback, tracking, regulator system, feed forward system, transfer function, concept of pole and zero, modeling of Electrical and Mechanical systems (Only series linear and rotary motion) using differential equations and transfer function ,analogy between electrical and mechanical systems, block diagram algebra, signal flow graph, Mason's gain formula | 8 |
| 2 | **Time domain analysis:** Concept of transient and steady state response, standard test signals: step, ramp, parabolic and impulse signal, type and order of control system, time response of first and second order systems to unit impulse, unit step input, time domain specifications of second order systems, derivation of time domain specifications for second- order under-damped system for unit step input, steady state error and static error coefficients | 8 |
| 3 | **Stability analysis and Root Locus:** Concept of stability: BIBO, nature of system response for various locations of poles in S-plane, Routh's- Hurwithz criterion. Root Locus: Angle and magnitude condition, Basic properties of root locus. Construction of root locus, Stability analysis using root locus. | 7 |
| 4 | **Frequency domain analysis**: Introduction to Frequency domain specifications, correlation between time and frequency domain specifications, polar Plot, Nyquist plot, stability analysis using Nyquist plot. Introduction to Bode plot, Asymptotic approximation: sketching of Bode plot, stability analysis using Bode plot | 7 |

| **Text Books:** |
|---|
| 1. I. J. Nagrath, M. Gopal, “Control System Engineering”, New Age International Publishers, 6th edition, 2017. |
| 2. R.AnandanatrajanandP.RameshBabu,“ControlSystemsEngineering”,Scitech Publication,3rdedition, 2011 |
| 3. D. Roy Choudhary, "Modern Control Engineering", PHI Learning Pvt.Ltd.,2005. |
| 4. Katsuhiko Ogata, “Modern control system engineering”, Prentice Hall, 2010. |
| |
| **Reference Books:** |
| 1. B. C. Kuo, “Automatic Control System”, Wiley India, 8th Edition,2003. |
| 2. Vande Vegte, John. Feedback Control Systems.3rded. Prentice Hall,1994. |
| 3. Nise N.S. “Control Systems Engineering”, John Wiley & Sons,Incorporated,2011 |
| 4. Richard C Dorf and Robert H Bishop, “Modern control system”, Pearson Education, 12th edition, 2011. |
| 5. Ogata, Katsuhiko. Solving Control Engineering Problems with MATLAB. Prentice Hall, 1993. |
| |
| **E-Resources:** |
| 1. www.nptel.ac.in (Learning platform from IIT profe**ssors)** |
| 2. www.discoveryforengineers.com (Investigating Discoveries) |
| 3. nptel.ac.in/courses/107106081 |

**Course Code:** BIC26PCL203 **Course Name:** Electrical Machines **Course Category:** PCC
**Credits:** 3 **Teaching scheme:** L-3 **Evaluation scheme:** CA–60, ESE–40
**Duration:** 2 h
**Pre-requisites:** Basic of Electrical and fundamentals of machines

**Course Objectives:**

1.To understand fundamental concepts in Python Programming
2.To learn the different Conditional Loops and Iteration
3.To understand various data structures and packages

**Course Outcomes:**

**CO1:**Analyze constructional aspects and operational aspects of electric machines
CO2: Evaluate performance parameters of electric machines.
CO3: Adopt suitable control methods for operating electric machines
CO4: Select appropriate electric machines based on constructional & operational characteristics

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **DC Motors**<br>Construction & operating principle, types of DC motors, PMDC motors, back-emf and its importance, torque production, characteristics, various losses and performance estimation ,speed control and applications | 12 |
| 2 | **Transformers**<br>Construction & operating principle-single phase and three phase, types of transformer, turn- ratio, equivalent circuit, various losses & performance estimation, parallel operation, applications<br>**Permanent Magnet Brushless DC(PMBLDC)Motors:** torque and Construction and operating principle emf equations, torque/speed characteristic: performance and efficiency, controllers for PMBLDC motors, applications | 12 |
| 3 | **Induction Motors**<br>Construction & operating principle of three phase machines, types of induction motors, torque production, torque-slip characteristic, equivalent circuit representation, various losses & performance estimation, speed control, single phase ac motors, universal motors and applications | 11 |
| 4 | **Special Purpose Motors**<br>Basics of stepper motor, construction, working and characteristics of variable reluctance(VR) stepper motors, micro stepping control of stepper motor, construction and working of multi stack VR stepper motor, construction and working of permanent magnet (PM)stepper motor, construction and working of hybrid stepper motor, servo motor types, construction and operation of servo motors, servo motor controllers, applications | 10 |

| **Text Books:** |
|---|
| 1. A.E. Fitzerald, Charles Kings ley and Stephen D Umans, Electric Machinery, TMH Publication. |
| 2. B.L. Theraja, A.K. Theraja, A Textbook of Electrical Technology Volume-II, S. Chand &Co. |
| |
| **Reference Books**: |
| 1. P.S. Bhimbra, Electrical Machinery, Dhanpatrai Publishers. |
| 2. Miller T. J. E., Brushless Permanent Magnet and Reluctance Motor Drives, Clarendon Press. |
| 3. V.V. Athani, Stepper Motors: Fundamentals, Applications and Design, New Age International Pvt. Ltd. |
| 4. P.C. Sen, Principles of Power Electronics, John Wiley and Sons. |
| |
| **E-Resources:** |
| Name of the website/ E-Journals/ Online Videos |
| 1. nptel.ac.in/courses/108102146 |

**Course Code:** BIC26PCP201 **Course Name:** Sensors and Transducers lab **Course Category:** PCC
**Credits:** 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20
**Pre-requisites:** Student should know the basic aspects of measurements like least count and range of instrument, scale identification, accuracy, error etc.

**Course Objectives:**
The Objective of this course are
1. To make the students gain practical knowledge to co-relate with the theoretical studies.
2. To achieve perfectness in experimental skills.
3. The study of practical applications will bring more confidence.

**Course Outcomes:**
At the end of the laboratory course, the students will be able to,
**CO1: To** Introduce different types of transducers.
**CO2:** Perform optical experiments; using light properties like interference, polarization, diffraction and their applications.
**CO3:** Interpret the results and analyze the data and use the experimental data to plot the graph for a best fit.
**CO4:** Discuss the characteristics of plateau region and determine operating voltage of G.M. counter
**CO5:** Determine the numerical aperture and bending loss of optical fibre cable

**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | To study the characteristics of LVDT | 02 |
| 2 | To study the characteristics of Variable Capacitor. | 02 |
| 3 | To study the characteristics of Light Dependent Resistor | 02 |
| 4 | To study the humidity sensor | 02 |
| 5 | To study the characteristics of Crompton Potentiometer. | 02 |
| 6 | To study the characteristics of Thermocouple. | 02 |
| 7 | To study the characteristics of Resistance Temperature Detector | 02 |
| 8 | To study the characteristics of Thermistor. | 02 |
| 9 | To study pressure sensors | 02 |
| 10 | To study flow measurement | 02 |

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|---|---|---|
| **Course Code** BIC26PCP202 | **Course Name:** Control System lab | **Course Category:** PCC |
| **Credits:** 1 | **Teaching scheme:** P-2 | **Evaluation scheme:** CA–30, ESE–20 |

**Pre-requisites:**

Student should know the basic aspects of measurements like least count and range of instrument, scale identification, accuracy, error etc.

**Course Objectives:**

The Objective of this course are

1. To Study time response of system
2. To achieve perfectness in experimental skills.
3. The study of practical applications will bring more confidence.

**Course Outcomes:**

At the end of the laboratory course, the students will be able to,

**CO1: To** Introduce different types of transducers.

**CO2:** To introduce temperature sensor

**CO3:** Use Matlab software to learn control systems.

**CO4:** Examine the response of control system by measuring relevant parameters under different disturbances



**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | Time response of system | 02 |
| 2 | Study of transfer function | 02 |
| 3 | To plot poles and zeros locations of a first order and second order transfer functions. Also simulate them to different inputs using Matlab | 02 |
| 4 | To find the closed loop transfer function of multi-loop feedback block diagram via block diagram reduction method using Matlab.. | 02 |
| 5 | To plot Root Locus using Matlab. | 02 |
| 6 | To plot Root Locus and identify stability of a system using Matlab. | 02 |
| 7 | To plot Nyquist plot and identify stability of a system using Matlab | 02 |
| 8 | To plot Bode plot and identify stability of a system using Matlab | 02 |
| 9 | To study DC potentiometer as error detector. | 02 |

**Course Code** BIC26PCP203 **Course Name:** Electrical Machines lab **Course Category:** PCC

**Credits:** 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20

**Pre-requisites:** Electrical machines fundamentals.

**Course Objectives:**

The Objective of this course are

1. To Study time response of system
2. To achieve perfectness in experimental skills.
3. The study of practical applications will bring more confidence.

**Course Outcomes:**

At the end of the laboratory course, the students will be able to,

**CO1: To** Introduce DC MOTOR.

**CO2:** To introduce Transformer

**CO3:** Use Introduce Stepper motor



**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | Study of DC MOTOR | 02 |
| 2 | Study of speed control of DC Motor | 02 |
| 3 | Study of Transformer | 02 |
| 4 | Study of Induction Motor | 02 |
| 5 | Study of Stepper Motor | 02 |
| 6 | Study of permanent magnet stepper Motor | 02 |
| 7 | Study of Servo Motor | 02 |
| 8 | Application of motors | 02 |

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|---|
| **Course code:** BRO21HSL205 **Course name:** Business Management and Financial Accounting **Course category:** EEMC<br>**Credits:** 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–60 ESE–40 Duration: 2h<br>**Pre-requisites:** Basic Management |
| **Course Objectives:**<br>1. To help the students to analyze the risk and return of alternative sources of financing.<br>2. To enable students to describe the estimated cash flows from a project, including operating, net working capital, and capital spending.<br>3. To provide the students to understand the related information of business Finance. Students can prepare basic financial statements.<br>4. To enable students to prepare final financial statements. |
| **Course Outcomes:**<br>At the end of the course, the students will be able to -<br>CO1: Analyze the risk and return of alternative sources of financing.<br>CO2: Estimate cash flows from a project, including operating, net working capital, and capital spending.<br>CO3: Define basic terminology used in finance and accounts.<br>CO4: Prepare Financial Statements. |

**Contents –**

| Unit | Content | Teaching hours |
|---|---|---|
| 1 | **INTRODUCTION TO BUSINESS MANAGEMENT:** Aims, Objective And Function of Business Management, Principles of Management, Concept of business finance, Goals & objectives of financial management, Sources of financing-Long Term financing and Short Term Financing | 07 |
| 2 | **BUSINESS CAPITAL MANAGEMENT:** Concept of business working Capital, significance, types. Adequacy of working capital, Factors affecting working capital needs, financing approaches for working capital, Methods of forecasting, working capital requirements | 08 |
| 3 | **BASICS OF FINANCIAL ACCOUNTING:** Meaning, Scope and importance of Financial Accounting. Financial Accounting - concepts and conventions, classification of accounts, Rules and principles governing Double Entry Book-keeping system, Meaning, Preparation of Journal, Ledger, Cash book & Trial balance. | 07 |
| 4 | **FINANCIAL STATEMENT PREPARATION AND ANALYSIS:** Preparation of financial statements. Profit & Loss Account, Balance Sheet, Ratio Analysis. | 08 |

| **Text Books:** |
|---|
| 1. Financial Management by Khan & Jain, Text, Problem & Cases, Tata McGraw Hill Publication 5th Edition. |
| 2. Tulsian Financial Management by Dr. P. C. Tulsian, S Chand Publication 5th Edition. |
| 3. Taxman's Financial Management by Ravi M. Kishore, Taxmann 2017 Edition |
| **Reference Books:** |
| 1. A Textbook of Financial, Cost & Management Accounting by Dr. P. Periasamy, Himalaya Pub. |
| 2. Fundamentals of Financial Management by Bhabhtosh Banerjee, PHI publication, 2nd Edition. |

**Course Code:** MGM56VEL102 **Course Name:** Constitution of India **Course Category:** VEC

**Credits:** 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–30, ESE–20

**Duration:** 1h

**Pre-requisites:** basics of Indian Constitution

**Objectives :**

1. To make students understand the Constitution and its importance
2. To sensitize the students about Fundamental Rights and duties enshrined under Indian
3. To familiarize students with the working of Indian Constitution

**Course Outcomes:**

At the end of the course, the students will be able to -

CO1: Understand and explain the significance of Indian Constitution as the fundamental law of the land

CO 2: Will be able to exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building

CO 3: To analyze the Indian political system, the powers and functions of the Union, State and Local Governments in detail

CO 4: To Understand Electoral Process, Emergency provisions and Amendment procedure

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **History :** Teaching Historical Background and Philosophy of Indian Constitution: Societies before and after the Constitution adoption. Introduction to the Indian constitution. Making of the Constitution. Role of the Constituent Assembly. Preamble and Nature of Indian Constitution Salient features of Indian Constitution | 8 |
| 2 | **Fundamental Rights & Duties :** Right to equality , Right to freedom Right against exploitation , Right to freedom of religion ,Cultural and educational rights ,Right to Constitutional remedies, Fundamental Duties Directive principles of state policy: Meaning and significance of Directive Principles ,Economic Principles , Political Principles | 8 |
| 3 | **4 Organs of Government:** Centre and State Legislature, Centre and State Executive Centre and State Judiciary ,Local Self Government | 7 |
| 4 | **Other Important Constitutional Provisions:** Emergency Provisions under Indian Constitution, Election Commission. | 7 |

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|---|
| **Text Books:** |
| 1. D. D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2013. |
| 2. Subhash Kashyap, Our Constitution (An Introduction of Indian constitution and Constitutional Law), National Book Trust, India, 2001 |
| 3. M. P. Jain, Outline of Indian Legal and Constitutional History, Lexis Nexis, 2014<br>Constitutional Law of India- J. N. Pandey- |
| |
| **Reference Books:** |
| 1. G. Austin, The Constitution of India, Cornerstone of a Nation. Oxford University press 1966. |
| 2. M.V. Pylee- Constitutional Government in India, Bombay Asia publishing House 1975. |
| 3. Chandra, Bipan and Others, India Since Independence, Penguin Books, New Delhi, 20015 |
| 4. H.M. Seervai Constitution of India. |
| 5. Narendra Chapalgaonker, Mahatma Gandhi and the Indian Constitution, Routledge (Manohar) Publication, |
| |
| **E-Resources:** |
| 1. www.nptel.ac.in (Learning platform from IIT profe**ssors)** |
| 2. www.discoveryforengineers.com (Investigating Discoveries) |
| 3. nptel.ac.in/courses/129106411 |

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|---|---|---|
| **Course code:** BIC26FPJ205 | **Course name:** Field Project | **Category:** FP |
| **Credit:** 2 | **Teaching scheme:** P-4 | **Evaluation scheme:** CA–30, ESE–20 |
| **Pre-requisites:** None | | |

**Course Objectives:**

1. To acquaint with the process of identifying the needs and converting it into the problem.
2. To familiarize the process of solving the problem in a group.
3. To acquaint with the process of applying basic engineering fundamentals to attempt solutions to problems.
4. To inculcate the process of self-learning and research.

**Course Outcomes:**

At the end of the course, the students will be able to -

CO1: Identify problems based on societal /research needs.

CO2: Apply Knowledge and skill to solve societal problems in a group.

CO3: Develop interpersonal skills to work as member of a group or leader.

CO4: Draw the proper inferences from available results through theoretical/ experimental/simulations.

CO5: Analyze the impact of solutions in societal and environmental context for sustainable development.



**Contents –**

**GUIDELINES FOR FIELD PROJECT:**

The students may be grouped into 2 to 4 and work under a project supervisor.

The device/case study/ system/component(s) to be design and develop shall be decided in consultation with the faculty supervisor and if possible with an industry/society. A field project report to be submitted by the group and the solution to system/case study/model/fabricated model, which will be reviewed and Evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination of the field project work is evaluated based on oral presentation and the project report jointly by external and internal examiners

Constituted by the Head of the Department.

**i.** Students shall form a group of 2 to 4 students.

**ii.** Students should do survey and identify needs, which shall be converted into problem statement for project in consultation with faculty supervisor.

**iii.** Student shall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of project. A log book to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.

iv. Faculty supervisor may give inputs to students during project activity; however, focus shall be on self-learning.
v. Students in a group shall understand problem effectively, propose multiple solution and select best possible solution in consultation with guide/ supervisor.
vi. Students shall convert the best solution into working model using various components of their domain areas and demonstrate.
vii. The solution to be validated with proper justification and report to be compiled in standard format with the focus on the self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the Projects.

**CONTINUOUS ASSESSMENT:**

The review/ progress monitoring committee shall be constituted by head of departments.

The progress of field project to be evaluated on continuous basis, minimum two reviews in the semester shall be conducted. In continuous assessment focus shall also be on each individual student, assessment based on individual's contribution in group activity, their understanding and response to questions.

**MARKS DISTRIBUTION OF CONTINUOUS ASSESSMENT AND**

**END SEMESTER EXAM ARE AS BELOW:**

Marks awarded based on Log Book: 15

Marks awarded based on Quality of Project Report: 15

Marks awarded by review committee (ESE): 20

**FIELD PROJECT SHALL BE ASSESSED BASED ON FOLLOWING POINTS :**

- Quality of problem and Clarity
- Innovativeness in solutions
- Cost effectiveness and societal impact
- Full functioning of working model as per stated requirements
- Effective use of skill sets
- Effective use of standard engineering norms
- Contribution of an individual's as member or leader
- Clarity in written and oral communication

## SEM IV

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| **Course Code:** BIC26PCL251 **Course Name :** Industrial Process Operations **Course Category**: PCC<br>**Credits:** 3 **Teaching scheme:** L-3 **Evaluation scheme:** CA–60, ESE–40<br>**Duration:** 2h<br>**Pre-requisites:** Fundamentals of Instrumentation |
| **Course Objectives:**<br>**1.** To study operations and its effects<br>**2.** To study equipments used for various operations |
| **Course Outcomes:**<br>At the end of the course, students will be able to,<br>CO1: Knowledge of unit operations and effect of different parameters on these operations.<br>CO2 : Acquaintance with different equipment used for unit operations.<br>CO3: Apply basic measures to control and monitor unit operations.. |

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **UNIT I**<br>Introduction: Unit operations and unit processes. Basic concepts of corrosion and protection from corrosion. Selection materials, metals & alloys used in construction of field instruments for different applications. Unit operations in different industries: Identification and justification of unit operations used in different industries like food, Pharma, paper, sugar, cement, fertilizer, Petrochemical industry with help of process flow diagram | 10 |
| 2 | **UNIT II**<br>**Transportation of Fluid & Equipment:**<br>Definition and classification, Rheological behavior of fluids & Newton's Law of viscosity. Fluid statics Pascal's law, Basic equations of fluid flow – Continuity equation, and Bernoulli equation; Types of flow – laminar and turbulent; Reynolds experiment. Basic understanding about piping, valves. Specifications and working of pumps, compressors, fans, blowers. Selection of equipment and its material for different applications.<br>**Heat transfer and Equipment:**<br>Modes of heat transfer; Conduction–steady state heat conduction, Convection- Forced and Natural convection, principles of heat transfer co-efficient, log mean temperature difference, individual and overall heat transfer co-efficient, fouling factor. Basic principles, working and selection criteria and control for double pipe, shell & tube heat exchangers, boilers, condensers, evaporators, cooling towers. | 12 |
| 3 | **UNIT III**<br>Mass transfer and Equipment: Mass, heat, and momentum transfer analogies Material balance with or without chemical reactions mass transfer coefficients. Principles, working design considerations and control for equipment used for unit operations like distillation, extraction, drying, humidification, dehumidification | 12 |

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|---|---|---|
| 4 | **UNIT IV**<br>Mechanical particulates and Screening and Equipment: Introduction of Particulate Sizes nd Shapes, Principle, working design considerations and control for equipment used for nit operations like Screening, Size Reduction, Filtration Cross Flow Filtration and lembrane Separations,GravitySedimentationProcesses,CentrifugalSeparations, Floatation | 11 |

| **Text Books:** |
|---|
| • Unit operations in Chemical Engineering by Warren L. McCabe, Julian C. Smith & Peter Herriot, McGraw-Hill Education ( India) Edition 2014. |
| • Transport Process Principles and Unit Operations by Christie Geankoplis, Prentice Hall of India |
| |
| **Reference Books:** |
| • Unit operations in Chemical Engineering by Warren L. McCabe, Julian C. Smith & Peter Herriot, McGraw-Hill Education ( India) Edition 2014. |
| • Transport Process Principles and Unit Operations by Christie Geankoplis, Prentice Hall of India |
| |
| **E-Resources:** |
| **Name of the website/ E-Journals/ Online Videos** |
| 1. nptel.ac.in/courses/108105064) |
| 2. Industrial Instrumentation NPTEL Study Materials - Video Lectures & Resources \| NPTELPrep |

**Course Code:** BIC26PCL252 **Course name:** Process Control **Course Category:** PCC
**Credits**: 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40 **Duration:** 2h
**Pre-requisites:**

1. Coordinate Geometry, Trigonometry, Sine & Cosine Rule, Unit Conversions
2. Fundamentals of Physic

**Course Objectives:**

To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

**Course Outcomes:**

Students are able to,

CO1: To Understand simple processes
CO2: To Design Feedback control systems
CO3: To understand and analyze friction gravity and moment of Inertia

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Dynamic behavior of simple processes** Objectives of Chemical Process Control, Mathematical modeling of chemical processes, State variables and state equations, Input-Output model, Linearization of nonlinear systems, Types of Forcing functions, dead-time systems, First order systems/processes Thermometer, Liquid level tank, Liquid level tank with constant outlet (pure capacitive), isothermal and non-isothermal CSTR, Dynamic response of first order system to impulse and step inputs, basic concepts of MIMO systems | 08 |
| 2 | **Design of single-loop feedback control systems** Second order systems/processes – Damped vibrator, Interacting and Non-interacting systems, Step response of second order system, Characteristics of under-damped system. Classical controllers – P, PI, PD, PID and ON- OFF controllers. Concept of feed-back control system, Servo & Regulatory problem, Block diagram reduction of complicated control systems, and Dynamic behavior of feed-back control processes | 07 |
| 3 | **Friction, Centre of Gravity and Moment of Inertia:** Friction: Introduction to friction, types and application, Laws of friction, Angle of friction, Angle of repose, Cone of friction, Problems on horizontal & inclined plane, block, and ladder.CG & MI: Design of Complex Control: Design of controllers with difficult dynamics such as large time delay system, inverse response system. Analysis and design of control system with multiple loops viz: cascade, selective, split range. Analysis and design of advance control system( feed forward, Ratio, Adaptive, Inferential.) | 08 |
| 4 | **Digital and Computer- based Control Systems:** | 07 |

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|---|---|---|
| | Sampling of continuous signals to discrete- time signals, reconstruction of continuous- time signals from discrete-time signals using hold elements, Digital approximation of classical controllers, Role of digital computer in process control as process interface for data acquisition and control, Centralized control systems, supervisory control systems (SCADA), microcomputer- based control systems (PLC, DCS), Plant wide control for plants involving compressor, Heat Exchanger, Adiabatic Plug Flow Reactor. | |

| **Text Books:** |
|---|
| 1. Chemical Process Control, George Stephanopoulos, PHI publication**,** |
| 2. Process System Analysis& Control, Donald R. Coughanour, McGraw Hill |
| 3. Process Control– Modeling, Design & Control, B. Wayne Banquette, PHI Publication |
| |
| **Reference Books:** |
| 1. Process Dynamics & Control, Dale E. Seaborg, Thomal F. Edgar, Dancan A. Melli champ |
| 2. Process Dynamics, Modeling &Control– Babatunde A. Ogunnaike, W. Harmon Ray, Oxford University Press Inc. |
| 3. Process Dynamics & Control- R.W. Gaikwad & S.A. Misal, Denett Publisher Nagpur |
| |
| **E-Resources:** |
| 1. www.nptel.ac.in (Learning platform from IIT profe**ssors)** |
| 2. **nptel.ac.in/courses/103101142** |
| 3. www.discoveryforengineers.com (Investigating Discoveries) |

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| **Course Code:** BIC26PCL253 **Course Name:** Microcontrollers & Embedded System **Course Category:** PCC<br>**Credits:** 3 **Teaching scheme:** L-3 **Evaluation scheme:** CA–60, ESE–40<br>**Duration:** 2 h<br>**Pre-requisites:** Basic Of Electronics And Electrical |
| **Course Objectives:**<br>1.To understand fundamental concepts of sensors and Transducers<br>2.To learn the different Measurements<br>3.To understand various environmental sensors |
| **Course Outcomes:**<br>CO1**:** Differentiate amongst various architectures of microcontrollers<br>CO2: Impart microcontroller programming and design skills<br>CO3: Interface and use different peripherals with microcontrollers<br>CO4: Evaluate and compare the performance of microcontrollers |

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Introduction to Microcontroller:**<br>Numbering system, Microcontrollers Vs Microprocessors, RISC and CISC architecture comparison. Von Neumann's. Harvard architecture, comparison between 8-bit, 16-bit, 32-bit Micro controller. Stack and use of stack pointer. Memory structure, Data Memory, Program Memory and execution of programs. | 12 |
| 2 | **Programming with microcontroller:**<br>Interface and use different peripherals with microcontrollers Programming: Concept of assembler directives, editor, linker, loader, debugger, simulator, emulator. Instruction set, basic programming using assembly instructions. Introduction to embedded-C, Integrated Development Environment (IDE), cross compiler, ISP, software delay generation. | 12 |
| 3 | **8 Bit micro-controller:**<br>Introduction to 8 bit microcontroller, Addressing Modes & Instruction Set, architecture and PIN description, Interrupts and Operating Modes, Analog Input-Output and PWM, Digital Input-Output, Memory Mapping (internal as well as external) of microcontroller | 9 |
| 4 | **I/O Interfacing:**<br>I/O programming, interfacing with simple switch, LED, Keypad programming. Timers, various modes of operations of timers, counters, PWM programming. | 12 |

| **Text Books:** |
|---|
| 1. Mazidi, "8051micro controller & embedded system" 3rd Edition, Pearson |
| 2. Mazidi, "PIC micro controller & embedded system" 3rd Edition, Pearson |
| 3. Kenneth J. Ayala, "8051 Microcontroller: Programming, Architecture and Interfacing", Thomas Delmar Learning, Third ed., 2007. |
| 4. Newnes, 1st Edition, 2010"MSP430 Micro controller Basics" by John H Davies |
| |
| **Reference Books:** |
| 1. Kenneth J. Ayala, "The 8051 Micro-controller–Architecture, Programming & Applications", Penram International & Thomson Asia, Second Edition. |
| 2. John B. Peatman, "Design with PIC Micro-controllers", Pearson Education Asia, Low Price Edition |
| 3. MSP430TechnicalReferenceManual |
| 4. Newnes Publication,2009*Texas Instruments MSP430 micro controller, Guide and Datasheet |
| 5. Muhammad A. Mazidi, "AVR Microcontroller and Embedded Systems: Assembly and C", Pearson; 1st edition, 2015 |
| |
| **E-Resources:** |
| 1. www.nptel.ac.in (Learning platform from IIT profe**ssors)** |
| 2. **nptel.ac.in/courses/103101142** |
| 3. www.discoveryforengineers.com (Investigating Discoveries) |
| 4. **nptel.ac.in/courses/108105102** |

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|---|---|---|
| **Course Code:** BIC26PCP252 | **Course Name:** Process control lab | **Course Category:** PCC |
| **Credits:** 1 | **Teaching scheme:** P-2 | **Evaluation scheme:** CA–30, ESE–20 |
| **Pre-requisites:** Fundamentals of Instrumentation | | |

**Course Objectives:**

The Objective of this course are

1. To Study simple processes
2. To study feedback systems.

**Course Outcomes:**

At the end of the laboratory course, the students will be able to,

CO1**:** Ability to understand and analyze process control engineering problems.

CO2 : To explain SCADA and PLC

CO3**:** Apply knowledge to build project

**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | Study of Process Control Training Plant and Compact Flow Control Unit. | 02 |
| 2 | PID Implementation Issues. | 02 |
| 3 | Tuning of PID Controller for mathematically described processes | 02 |
| 4 | Auto-tuning of PID Controller | 02 |
| 5 | CLOSED LOOP RESPONSE OF LEVEL CONTROL LOOP | 02 |
| 6 | Analysis and design of advance control system | 02 |
| 7 | Study of SCADA | 02 |
| 8 | Study of PLC | 02 |

**Course Code** BIC26PCP253 **Course Name:** Microcontroller & Embedded system lab **Course Category:** PCC

**Credits:** 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20

**Pre-requisites:** Digital Electronics Fundamentals

**Course Objectives:** The Objective of this course are

1. To Study 8 Bit Microcontroller

2. To Study Microcontroller Interfacing.

**Course Outcomes:**

At the end of the laboratory course, the students will be able to,

**CO1:** To Introduce 8 bit controller

**CO2:** To understand and use compilers

**CO3:** apply knowledge to build project

**Contents:**

| Sr. No. | List of Practical | Lab Hours |
|---|---|---|
| 1 | Study of Introduction to microcontroller | 02 |
| 2 | Study of fundamentals of programming compilers | 02 |
| 3 | Arithmetic operations using 8 bit controller | 02 |
| 4 | Data transfer using 8 bit controller | 02 |
| 5 | Logical operations using 8 bit controller | 02 |
| 6 | LED interfacing using 8 bit controller | 02 |
| 7 | Relay interfacing using 8 bit controller | 02 |
| 8 | Application of 8 bit controller | 02 |

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|---|---|---|
| **Course Code:**BICVSP254 | **Course name:** Industry 4.0 Lab | **Course Category:** VSEC |
| **Credits:** 1 | **Teaching scheme:** L-2 | **Evaluation scheme:** CA–30, ESE–20 |
| **Duration:** 2h | | |
| **Pre-requisites:** Fundamentals Of Sensors Simulators | | |
| **Course Objectives:** To study and practice industry 4.0 | | |
| **Course Outcomes:** Students are able to,<br>CO1. Understand the key attributes of industry 4.0<br>CO2. Understand conceptual framework for industry 4.0<br>CO3 To understand role of industry 4.0 in real world | | |

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Introduction**<br>Introduction to industry 4.0, core idea of 4.0, concept,, current status of industry 4.0, how India preparing it. | 02 |
| 2 | **A Conceptual Framework for Industry 4.0:**<br>Introduction, Main Concepts and Components of Industry 4.0, State of Art, Supportive Technologies, Proposed Framework for Industry 4.0. | 03 |
| 3 | **Advances in Robotics in the Era of Industry 4.0:**<br>Introduction, Recent Technological Components of Robots- Advanced Sensor Technologies, Internet of Robotic Things, Cloud Robotics, and Cognitive Architecture for Cyber-Physical Robotics, Industrial Robotic Applications- Manufacturing, Maintenance and Assembly. | 06 |
| 4 | **The Role of Augmented Reality in the Age of Industry 4.0:**<br>Introduction, AR Hardware and Software Technology, Industrial Applications of AR. | 04 |



**Text Books:**

1. Alp Ustundag and Emre Cevikcan," Industry 4.0: Managing the Digital Transformation".
2. Bartodziej, Christoph Jan" The Concept Industry 4.0".
3. Klaus Schwab,"The Fourth Industrial Revolution".
4. Christian Schröder," The Challenges of Industry 4.0 for Small and Medium-sized Enterprises"

**Reference Books:**

1. Alp Ustundag and Emre Cevikcan," Industry 4.0: Managing the Digital Transformation".
2. Bartodziej, Christoph Jan,"The Concept Industry 4.0".
3. Klaus Schwab,"The Fourth Industrial Revolution".
4. Christian Schröder ,"The Challenges of Industry 4.0 for Small and Medium-sized Enterprises".

**E-Resources:**

1. www.nptel.ac.in/

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|---|---|---|
| **Course Code:**BIC26VSP255 | **Course name:** Industrial Safety | **Course Category:** VSEC |
| **Credits:** 1 | **Teaching scheme:** P-2 | **Evaluation scheme:** CA–30, ESE–20 |
| **Duration:** 2h | | |
| **Pre-requisites:** Fundamentals Industry Technical Structure | | |

**Course Objectives:** To study and practice industry safety

**Course Outcomes:**

Students are able to,

CO1. Understand noise safety

CO2. Understand conceptual sensitivity test

CO3. To understand Personal and fire safety

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **NOISE LEVEL MEASUREMENT AND ANALYSIS** Measurement of noise level for various sources – Impact, continuous and intermittent. Frequency and spectrum analysis of noise: Instrument – precision type of Noise level meter with frequency and spectrum analyzer | 03 |
| 2 | **VIBRATION MEASUREMENT AND ANALYSIS** Measurement of whole body vibration for various acceleration: Instrument – vibration simulator and vibration analyzer | 02 |
| 3 | **SENSITIVITY TEST** Measurement of thermal reactivity for unstable materials, Measurement of impact sensitivity for unstable materials | 02 |
| 4 | **STUDY OF PERSONAL PROTECTIVE EQUIPMENT:** Types, need of PPE Safety helmet, belt, hand gloves, goggles, safety shoe, gum boots, ankle shoes, face shield, nose mask, ear plug, ear muff, apron and leg guard.<br>**STUDY OF FIRE EXTINGUISHERS** Fire triangh, types of fire, fire load, fire fighting: Method fire alarms, fire detection, fire hydrant systems. Selection and demonstration of first-aid fire extinguishers: soda acid, foam, carbon dioxide (CO2), dry chemical powder, halon | 08 |

**Note:** field visit to study all above points practically

| | | |
|---|---|---|
| **Course Code:**BIC26HSL256 | **Course name:** Entrepreneurship Development | **Course Category:** EEMC |
| **Credits:** 2 | **Teaching scheme:** L-2 | **Evaluation scheme:** CA–60, ESE–40 |
| **Duration:** 2h | | |
| **Pre-requisites:** Fundamentals Of Social Science | | |

**Course Objectives:**

To study and practice entrepreneur concept and attributes

**Course Outcomes:**

Students are able to,

CO1. Understand the key attributes and mindsets of entrepreneurial and entrepreneurial leadership by analyzing role models and their contribution to economic development

CO2. Apply design thinking principles to identify a real-world problem, define customer segments, and validate needs through primary research.

CO3. To understand and analyze friction gravity and moment of Inertia

CO4 Analyze the components of a business model using the Lean Canvas framework to identify riskiest assumptions and validate value propositions.

**Contents:**

| Unit | Content | Teaching Hours |
|---|---|---|
| 1 | **Introduction**<br>Meaning and concept, attributes and mindset of entrepreneurial and entrepreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skill sets, attributes and networks while on campus. | 08 |
| 2 | **Understanding and analyzing the macro-Problem**<br>Understanding and analyzing the macro-Problem and Industry perspective, technological, socio economic and urbanization trends and their implication on new opportunities. Identifying passion, identifying and defining problem using Design thinking principles. Analyzing problem and validating with the potential customer. Iterating problem-customer fit. Understanding customer segmentation, creating and validating customer personas. Competition and Industry trends mapping and assessing initial opportunity | 07 |
| 3 | **Understanding Customer Jobs-to-be-done**<br>Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer's needs and create a strong value proposition. Developing Problem-solution fit in an iterative manner. Understanding prototyping and MVP. | 08 |
| 4 | **Developing a feasibility prototype**<br>Developing a feasibility prototype with differentiating value, features and benefits. Initial testing for proof-of concept and iterate on the prototype. Assess relative market position via competition analysis, sizing the market and assess scope and potential scale of the opportunity..) | 07 |

| **Text Books:** |
|---|
| 1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGraw Hill, 11th Edition. |
| 2. Ries, E. (2011). The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business |
| |
| **Reference Books:** |
| 1. Shoba Nath Singh, Non- Conventional Energy Resources, Pearson Publications, 2015. |
| 2. Oster walder, A., & Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons. |
| 3. Simon Sinek (2011) Start with Why, Penguin Books limited 4. Brown Tim (2019) Change by Design Revised & Updated: How Design Thinking Transforms Organizations and Inspires Innovation, Harper Business |
| |
| **E-Resources:** |
| 1. https://onlinecourses.nptel.ac.in/noc25_de20/preview |
| 2. Learning resource and Venture Creation- Ignite 5.0 Course Wadhwani platform (Includes 200+ components of custom created modular content and 500+ components of the most relevant curated content) |