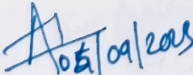# Walchand College of Engineering

*(Government Aided Autonomous Institute)*

Vishrambag, Sangli. 416415



1947

# Course Contents for

# S. Y. M. Tech. (Control System Engineering)

## Semester III & IV

## 2023-24

PG Coordinator

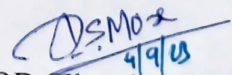HOD (Electrical Engg.)

# Walchand College of Engineering

*(Government Aided Autonomous Institute)*

Vishrambag, Sangli. 416415

## Course Contents for

## S.Y. M.Tech. (Control System Engineering)

## Sem III and IV

2023-24

# Sem-III
# Professional Core (Theory)
# Courses

# Walchand College of Engineering, Sangli
*(Government Aided Autonomous Institute)*

## AY 2023-24

### Course Information

| | |
|---|---|
| **Programme** | M. Tech. (Control System Engineering) |
| **Class, Semester** | Second Year M. Tech., Sem I |
| **Course Code** | 6CS601 |
| **Course Name** | Legal, Financial aspects of industrial project |
| **Desired Requisites:** | — — — |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| | | **MSE** | **ISE** | **ESE** | **Total** |
| **Lecture** | 2 Hrs/week | 30 | 20 | 50 | 100 |
| **Tutorial** | | | | | |
| | | **Credits: 2** | | | |

### Course Objectives

| | |
|---|---|
| 1 | To identify and analyze the relevant legal issues involved in Industrial Project and criminal matters affecting business. |
| 2 | To understand theories of value, risk and return, capital investment decisions, wages and working hours, insurance schemes, labour laws. |
| 3 | To become familiar with intellectual property in cyber space and different cyber laws. |

### Course Outcomes (CO) with Bloom's Taxonomy Level

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

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| **CO1** | To understand the terms involved and laws applicable for an Industrial Project. | II | Understanding |
| **CO2** | To get acquainted with investments, taxes and employee schemes. | III | Applying |
| **CO3** | To be familiar with Cyber laws applicable for cyber crimes. | III | Applying |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Economic Decision Making** Introduction, Mathematics of Time Value of Money: Compound Interest, Cash Flow Diagram, Uniform Annual Series, Irregular Cash Flows, Cost Comparison: Present Worth Analysis, Annual Cost Analysis, Capitalized Cost Analysis | 4 |
| II | **Taxes and Profitability** Taxes, Profitability of Investments: Rate of Return, Payback Period, Net Present Worth, Internal Rate of Return, Inflation, Sensitivity and Break-Even Analysis, Uncertainty in Economic Analysis | 4 |
| III | **Factories Act, 1948** Health, Safety, Provisions relating to Hazardous Processes, Welfare, Working Hours of Adults, Employment of young 4 Couse Contents for M.Tech Programme, Department of Electrical Engineering, AY 2021-22 persons, Annual Leave with wages. The Employees Provident Fund and Miscellaneous Provisions Act, 1952. | 4 |
| IV | **Constitution and Labour Laws** labour laws, Equality before law and its application in Labour Laws, Equal pay for equal work; and Article-16 and reservation policies, Articles 19, 21, 23 and 24 and its implications. | 4 |
| V | **Intellectual Property in Cyber Space** Computer Software and Copyright Law, Software Licences, Computer Databases and the law, Domain Names and the law, Trademark issues in cyberspace | 4 |

| VI | **Cyber Crimes and Cyber Laws**<br>Cyber Crimes, Malware, Computer Source Code, Digital Signature, Information Technology Laws, IT ACT & how to prevent yourself from being a victim of Cyber Crime. | 4 |
|---|---|---|

### Textbooks

| | |
|---|---|
| 1 | P.L. Mehta, "*Managerial Economics Analysis, Problems and cases*", S. Chand & Co.Ltd., 2001 |
| 2 | Dieter G.E., "*Engineering Design*", McGraw-Hill Education 5 th edition, 2012 |
| 3 | N. Godbole, S. Belapure, "*Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*", Wiley India Pvt. Ltd. |
| 4 | Canter, L. W, "*Environmental Impact Assessment*", McGraw-Hill, 2 nd Edition, 1997. |
| 5 | "*Environmental Auditing*", Published by CPCB, Govt. of India Publication, New Delhi. |

### References

| | |
|---|---|
| 1 | Peterson and Lewis: "*Managerial Economics*", 4 th Ed., Prentice Hall , 2004 |
| 2 | R. Drefuss, J. Pila; " *The Oxford Handbook of Intellectual Property Law*", Oxford University Press, 2018. |
| 3 | Adv. P. Mali, "*Cyber Law & Cyber Crimes Simplified*", Cyber Infomedia, 2017. |
| 4 | No.29 of 1986, [23/5/1986] - The Environment (Protection) Act, 1986, amended 1991 |
| 5 | G.S.R.830(E), [24/11/2011] - The Water (Prevention and Control of Pollution) Amendment Rules, 2011. |
| 6 | No.14 of 1981, [29/3/1981] - The Air (Prevention and Control of Pollution) Act 1981, amended 1987 |

### Useful Links

| | |
|---|---|
| 1 | - |

### CO-PO Mapping

| | Programme Outcomes (PO) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| CO1 | | | | 2 | | |
| CO2 | | 2 | | | 1 | |
| CO3 | | | | 2 | | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

### Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

# Professional Core (Lab) Courses

# Walchand College of Engineering, Sangli
*(Government Aided Autonomous Institute)*

## AY 2023-24

## Course Information

| | |
|---|---|
| **Programme** | M. Tech. (Control System Engineering) |
| **Class, Semester** | Second Year M. Tech., Sem I |
| **Course Code** | 6CS645 |
| **Course Name** | Dissertation Phase I |
| **Desired Requisites:** | Concept knowledge of research methodology, project management, Electrical Engineering |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| **Practical** | 6 Hrs/ Week | **MSE/LA1** | **ISE/LA2** | **ESE** | **Total** |
| **Interaction** | | 100 | | | 100 |
| | | Credits: 3 | | | |

## Course Objectives

| | |
|---|---|
| 1 | To develop the student to apply the knowledge gained to identify problems for research and provide the solutions by self-study and interaction with stakeholders. |
| 2 | Acquire knowledge to tackle real world problems of societal concerns |
| 3 | Impart flexibility to the student to have increased control over his/ her learning |
| 4 | Teachers would serve as mentor/facilitator of inquiry and reflection rather than as an instructor |
| 5 | Enhance a students' learning through increased interaction with peers and colleagues. |

## Course Outcomes (CO) with Bloom's Taxonomy Level

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

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| CO1 | **Search** the existing literature and identification of research problem | IV | Analyze |
| CO2 | **Design and develop** the solution for complex engineering problem | V | Evaluate |
| CO3 | **Create** the new knowledge in the specialized field | VI | Create |

## List of Experiments / Lab Activities/Topics

ISE for dissertation phase I is based on the efforts by the student for synopsis preparation. It shall be evaluated using the parameters extent of literature review, scope defined, objectives, and fundamental concepts, quality of presentation, and interaction during presentation, effort/work done, quality of report and interaction with guide.

## Textbooks

| | |
|---|---|
| 1 | As per the research topic |

## References

| | |
|---|---|
| 1 | National and International Journals |

## Useful Links

| | |
|---|---|
| 1 | https://nptel.ac.in/courses/121/106/121106007/ |
| 2 | https://www.youtube.com/watch?v=mAVswCbz_jM&feature=emb_imp_woyt |
| 3 | https://nptel.ac.in/courses/110/104/110104073/ |
| 4 | https://nptel.ac.in/courses/110/107/110107081/ |

| CO-PO Mapping | | | | | | |
|---|---|---|---|---|---|---|
| | Programme Outcomes (PO) | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 |
| CO1 | 1 | | | 1 | | 2 |
| CO2 | 1 | | 1 | | 2 | 1 |
| CO3 | | 2 | | | | 1 |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

### Course Information

| | |
|---|---|
| Programme | M. Tech. (Control System Engineering) |
| Class, Semester | Second Year M. Tech., Sem I |
| Course Code | 6CS646 |
| Course Name | Dissertation Phase II |
| Desired Requisites: | Concept knowledge of research methodology, project management, Electrical Engineering |

| Teaching Scheme | | Examination Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|
| | | MSE/LA1 | ISE/LA2 | — | ESE | Total |
| Practical | 6 Hrs/ Week | | | | | |
| Interaction | | | 100 | | | 100 |
| | | | Credits: 3 | | | |

### Course Objectives

| | |
|---|---|
| 1 | To develop the student to apply the knowledge gained to identify problems for research and provide the solutions by self-study and interaction with stakeholders. |
| 2 | Acquire knowledge to tackle real world problems of societal concerns |
| 3 | Impart flexibility to the student to have increased control over his/ her learning |
| 4 | Teachers would serve as mentor/facilitator of inquiry and reflection rather than as an instructor |
| 5 | Enhance a students' learning through increased interaction with peers and colleagues. |

### Course Outcomes (CO) with Bloom's Taxonomy Level

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

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| CO1 | **Search** the existing literature and identification of research problem | IV | Analyze |
| CO2 | **Design and develop** the solution for complex engineering problem | V | Evaluate |
| CO3 | **Create** the new knowledge in the specialized field | VI | Create |

### List of Experiments / Lab Activities/Topics

ISE for dissertation phase II is based on the progress made during the semester for the objectives defined in the synopsis and the report submitted by the students. It shall be evaluated through progress seminar(s) at the end of the semester. The parameters for evaluation include extent of work done, results and discussion/publication efforts, quality of presentation, quality of report, interaction during presentation and interaction with guide. ISE shall be conducted by Dissertation Evaluation Committee (DEC).

### Textbooks

| | |
|---|---|
| 1 | As per the research topic |

| References | |
|---|---|
| 1 | National and International Journals |

| Useful Links | |
|---|---|
| 1 | https://nptel.ac.in/courses/121/106/121106007/ |
| 2 | https://www.youtube.com/watch?v=mAVswCbz_jM&feature=emb_imp_woyt |
| 3 | https://nptel.ac.in/courses/110/104/110104073/ |
| 4 | https://nptel.ac.in/courses/110/107/110107081/ |

## CO-PO Mapping

| | Programme Outcomes (PO) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| CO1 | 1 | | | 1 | | 2 |
| CO2 | 1 | | 1 | | 2 | 1 |
| CO3 | | 2 | | | | 1 |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

# Walchand College of Engineering, Sangli
*(Government Aided Autonomous Institute)*
## AY 2023-24

### Course Information

| | |
|---|---|
| Programme | M. Tech. (Control System Engineering) |
| Class, Semester | Second Year M. Tech., Sem I |
| Course Code | 6CS647 |
| Course Name | Dissertation Phase III |
| Desired Requisites: | Concept knowledge of research methodology, project management, Electrical Engineering |

| Teaching Scheme | | Examination Scheme (Marks) | | | | |
|---|---|---|---|---|---|---|
| Practical | 8 Hrs/ Week | MSE/LA1 | ISE/LA2 | | ESE | Total. |
| Interaction | | | | | 100 | 100 |
| | | Credits: 4 | | | | |

### Course Objectives

| | |
|---|---|
| 1 | To develop the student to apply the knowledge gained to identify problems for research and provide the solutions by self-study and interaction with stakeholders. |
| 2 | Acquire knowledge to tackle real world problems of societal concerns |
| 3 | Impart flexibility to the student to have increased control over his/ her learning |
| 4 | Teachers would serve as mentor/facilitator of inquiry and reflection rather than as an instructor |
| 5 | Enhance a students' learning through increased interaction with peers and colleagues. |

### Course Outcomes (CO) with Bloom's Taxonomy Level

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

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| CO1 | **Search** the existing literature and identification of research problem | IV | Analyze |
| CO2 | **Design and develop** the solution for complex engineering problem | V | Evaluate |
| CO3 | **Create** the new knowledge in the specialized field | VI | Create |

### List of Experiments / Lab Activities/Topics

ESE for dissertation phase III shall be conducted at the end of semester by a duly constituted examination panel composed of Chairman, internal examiner (guide) and external examiner.

### Textbooks

| | |
|---|---|
| 1 | As per the research topic |

### References

| | |
|---|---|
| 1 | National and International Journals |

### Useful Links

| | |
|---|---|
| 1 | https://nptel.ac.in/courses/121/106/121106007/ |
| 2 | https://www.youtube.com/watch?v=mAVswCbz_jM&feature=emb_imp_woyt |
| 3 | https://nptel.ac.in/courses/110/104/110104073/ |
| 4 | https://nptel.ac.in/courses/110/107/110107081/ |

Course Contents for MTech Programme, Department of Electrical Engineering, AY2023-24

| CO-PO Mapping | | | | | |
|---|---|---|---|---|---|
| **Programme Outcomes (PO)** | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **6** |
| **CO1** | 1 | | | 1 | | 2 |
| **CO2** | 1 | | 1 | | 2 | 1 |
| **CO3** | | 2 | | | | 1 |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

# Walchand College of Engineering, Sangli
*(Government Aided Autonomous Institute)*

## AY 2023-24

### Course Information

| | |
|---|---|
| **Programme** | M. Tech. (Control System Engineering) |
| **Class, Semester** | Second Year M. Tech., Sem I |
| **Course Code** | 6CS651 |
| **Course Name** | Industry Orientation Course |
| **Desired Requisites:** | |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| Practical | | **LA1** | **LA2** | **Lab ESE** | **Total** |
| Interaction | 1 Hrs/ Week | 30 | 30 | 40 | 100 |
| | | **Credits: 1** | | | |

### Course Objectives

| | |
|---|---|
| 1 | To provide a hands on experience of software in solving complex electrical engineering problems. |
| 2 | To enhance the employability of electrical control engineering student. |

### Course Outcomes (CO) with Bloom's Taxonomy Level

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

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| CO1 | **Use** of the software related to design of electrical system effectively. | V | Evaluate |
| CO2 | **Develop** the solution for electrical engineering problem using software. | VI | Create |
| CO3 | **Explain** the working of research and development department. | II | Understand |

### List of Experiments / Lab Activities/Topics

This course is based on computers as a tool to design and analyse the electrical system. In the modern day work environment, Electrical Engineer should be able to simulate and solve complex problems on computers. Electrical Engineer must be highly computer literate. The engineer with strong fundamentals in Control Engineering and computer software proficiency is highly in demand from industry. Employability of the student can be enhanced by providing software training of Analysis and simulation software in electrical engineering.

### Textbooks

| | |
|---|---|
| 1 | Suitable books based on the software selected. |

### References

| | |
|---|---|
| 1 | Suitable books based on the contents of software selected |

### Useful Links

| | |
|---|---|
| 1 | As per the need of the software training |

Course Contents for MTech Programme, Department of Electrical Engineering, AY2023-24

## CO-PO Mapping

| | Programme Outcomes (PO) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| CO1 | | 1 | | | | |
| CO2 | | | 2 | | | 2 |
| CO3 | | | | 3 | | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

## Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

| Assessment | Based on | Conducted by | Typical Schedule | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 8 Marks Submission at the end of Week 8 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 9 to Week 16 Marks Submission at the end of Week 16 | 30 |
| Lab ESE | Lab activities, journal/ performance | Lab Course Faculty and External Examiner as applicable | During Week 18 to Week 19 Marks Submission at the end of Week 19 | 40 |

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

# Walchand College of Engineering, Sangli
*(Government Aided Autonomous Institute)*
## AY 2023-24
### Course Information

| Programme | M. Tech. (Control System Engineering) |
|---|---|
| Class, Semester | Second Year M. Tech., Sem I |
| Course Code | 6CS611 |
| Course Name | Professional Elective 4: Modern Power Electronics |
| Desired Requisites: | Power Electronics |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| Lecture | 3 Hrs/week | **MSE** | **ISE** | **ESE** | **Total** |
| Tutorial | | 30 | 20 | 50 | 100 |
| | | **Credits: 3** | | | |

### Course Objectives

| 1 | It is aimed to impart skills of analysis for different types of advanced converters and shunt active power filters. |
|---|---|
| 2 | Make the students acquainted with control strategies of different types of advanced converters and shunt active power filters. |
| 3 | To make aware of research avenues in the field of power electronics. |

### Course Outcomes (CO) with Bloom's Taxonomy Level

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

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| CO1 | **Interpret** configuration and working of various Power Electronic converters. | III | Apply |
| CO2 | **Analyze** various Power Electronic converters and systems. | IV | Analyze |
| CO3 | **Evaluate** various power electronic systems using power electronic converters. | V | Evaluate |

| Module | Module Contents | Hours |
|---|---|---|
| I | **PWM rectifiers**<br>Advantages & disadvantages of three phase thyristor converter, Single phase and three phase VSI PWM converters working, types, Control of PWM rectifiers, analysis and application. Three phase CSI PWM converter, control and applications. | 6 |
| II | **Multilevel inverters**<br>Three phase two level Voltage source inverter, various PWM methods, Multilevel Voltage source inverter, Types: Diode clamp multilevel inverter, flying capacitor multilevel inverter, cascaded multilevel inverter, applications of multilevel inverters, comparison of multilevel inverter. Control method: Multiple carrier PWM for MLI | 6 |
| III | **Resonant pulse inverters**<br>Series resonant inverter with unidirectional and bi-directional switches, parallel resonant inverters, voltage control of resonant inverters, zero current and zero voltage switching resonant converters, two-quadrant ZVS resonant converters, resonant DC link inverters and control technique. | 6 |
| IV | **Photovoltaic Inverters**<br>Photovoltaic Inverters structures derived from H bridge topology such as H5 inverter, Heric inverter, REFU inverter, full bridge inverter with DC bypass, inverter structures derived from NPC topology such as neutral point clamped half bridge inverter, conergy NPC inverter, three phase PV inverter. | 6 |

| | | |
|---|---|---|
| V | **Matrix Converters and Z source inverters**<br>Topology, working and control methods of Matrix converters, Various circuit topologies and control of Z source inverter, Application of Z source in induction motor control. | 6 |
| VI | **Active power filters**<br>Power Quality Issues due to power Electronics, Introduction to active power filter, types of active power filters overall control of shunt active power filter, control of shunt active filter based on SRF theory. Control of shunt active filter based on instantaneous power theory. harmonic compensation & reactive power compensation. | 6 |

## Textbooks

| | |
|---|---|
| 1 | M. H. Rashid, *"Power Electronics: circuits devices and applications"*, Pearson Education, Third edition. |

## References

| | |
|---|---|
| 1 | B. K. Bose, *"Modern Power Electronics and AC drives"*, PHIPL, New Delhi. |
| 2 | M. B. Patil, V. Ramayanan and V. T. Ranganathan, *"Simulation of Power Electronics circuits"*, Narosa publication. |
| 3 | Remus Teodorescu, Marco Liserre and Pedro Rodrigues, *"Grid- Converters for Photovoltaic and Wind Power Converters"*, A john Wiley and sons Ltd., first edition 2011. |
| 4 | IEEE Transaction papers. |

## Useful Links

| | |
|---|---|
| 1 | NPTEL lectures on Advanced Power Electronics |

## CO-PO Mapping

| | Programme Outcomes (PO) | | | | | |
|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| CO1 | | | 1 | | | |
| CO2 | | | | 1 | | |
| CO3 | | | | 2 | | 1 |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

## Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Course Contents for MTech Programme, Department of Electrical Engineering, AY2023-24

# Walchand College of Engineering, Sangli
*(Government Aided Autonomous Institute)*

## AY 2023-24

### Course Information

| | |
|---|---|
| **Programme** | M.Tech. (Control System Engineering) |
| **Class, Semester** | Second Year M. Tech., Sem I |
| **Course Code** | 6CS612 |
| **Course Name** | Professional Elective 4: Robust Control |
| **Desired Requisites:** | Engineering Mathematics — — |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| | | **MSE** | **ISE** | **ESE** | **Total** |
| **Lecture** | 3 Hrs/week | 30 | 20 | 50 | 100 |
| **Tutorial** | | | | | |
| | | **Credits: 3** | | | |

### Course Objectives

| | |
|---|---|
| 1 | This course provides the basic concepts of robust control. |
| 2 | It provides the methodology of design of robust control. |
| 3 | It gives the overview of h-infinity design |

### Course Outcomes (CO) with Bloom's Taxonomy Level

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

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| CO1 | **Explain** basic concepts of robust control. | II | Understanding |
| CO2 | **Apply** robust control design and stability analysis | III | Applying |
| CO3 | **Analyze** the H∞-Control. | IV | Analyzing |

| Module | Module Contents | Hours |
|---|---|---|
| I | **Robust Control**<br>Introduction to Basic Concepts, Systems and Signals, Stability of LTI Systems, Controller design, Loop shaping, Closed loop Transfer function loop shaping, Linear Fractional transformations. | 6 |
| II | **Stabilizing Controllers**<br>Internal stability, stabilizing controllers, Stabilizing Controllers - State-Space Descriptions, stability analysis in frequency domain, system norms | 6 |
| III | **Limitations on Performance**<br>Limitations on performance SISO and MIMO systems, sensitivity, time lags, uncertainties, phase lag, performance requirements imposed by disturbances and commands. | 6 |
| IV | **Uncertainty and Robustness**<br>Introduction to robustness, Uncertainties and representation, Configuration, Types of Uncertainties of System Components, SISO Robust performance and Stability. | 6 |
| V | **Robust Stability and Performance**<br>General control configuration, representing uncertainty, Introduction to Stability and Robust Performance Test, structured and unstructured uncertainty, SSV ,mu-synthesis and DK iteration. | 6 |
| VI | **Controller Design**<br>LQG control, H2 and H∞-Control, H∞ loop shaping,, H∞ loop shaping design, introduction to model reduction techniques , balanced realizations, hankel norm approximation, reduction of unstable models. | 6 |

## Textbooks

| | |
|---|---|
| 1 | Kemin Zhou, *"Essentials of Robust Control"*, Prentice Hall Publications, 1997. |
| 2 | Kemin Zhou, John Doyle, *"Robust and Optimal Control"*, Feher-Prentice Hall Publications, 1995. |
| | |

## References

| | |
|---|---|
| 1 | P. H. Petkov, M.M. Konstantinov, *"Robust Control Systems"*, Springer Publications, 2005. |
| 2 | Sigurd Skogestad, Ian Postlethwaite, *"Multivariable Feedback Control"*, Wiley Publications, 2005. |
| | |

## Useful Links

| | |
|---|---|
| 1 | - |

## CO-PO Mapping

| | Programme Outcomes (PO) | | | | | |
|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| CO1 | | | 1 | | | |
| CO2 | | | | 1 | | |
| CO3 | | | | 2 | | 1 |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

## Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

# AICTE Mandatory Courses

# Walchand College of Engineering, Sangli
## (Government Aided Autonomous Institute)
### AY 2023-24

## Course Information

| | |
|---|---|
| Programme | M.Tech. (Control System Engineering) |
| Class, Semester | Second Year M. Tech., Sem I |
| Course Code | 6IC601 |
| Course Name | Value Education |
| Desired Requisites: | - |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| Lecture | 2 Hrs/week | MSE | ISE | ESE | Total |
| Tutorial | | 30 | 20 | 50 | 100 |
| | | Credits: 0 | | | |

## Course Objectives

| 1 | To impart knowledge on value of education and self- development. |
|---|---|
| 2 | To imbibe good values in students. |
| 3 | To highlight importance of character. |

## Course Outcomes (CO) with Bloom's Taxonomy Level

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

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| CO1 | **Explain** value of education and self- development. | II | Understand |
| CO2 | **Summarize** importance of good character, and Behaviour development. | IV | Evaluate |

| Module | Module Contents | Hours |
|---|---|---|
| I | Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism, Moral and non- moral valuation. Standards and principles, Value judgments. | 6 |
| II | Importance of cultivation of values, Sense of duty. Devotion, Self-reliance, confidence, Concentration. Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline. | 6 |
| III | Personality and Behaviour Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour universal brotherhood and religious tolerance, True friendship, Happiness vs. suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature | 7 |
| IV | Character and Competence –Holy books vs. Blind faith, Self-management and Good health, science of reincarnation, Equality, Nonviolence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control. Honesty, Studying effectively | 7 |

## Textbooks

| 1 | Chakroborty, S.K. "*Values and Ethics for organizations Theory and practice*", Oxford University Press, New Delhi |
|---|---|

## References

| 1 | - |
|---|---|

## Useful Links

Course Contents for MTech Programme, Department of Electrical Engineering, AY2023-24

| | |
|---|---|
| 1 | https://nimsuniversity.org/wp-content/uploads/2018/02/Value-Education-Human-Rights-and-Legislative-Procedures.pdf |
| 2 | http://cbseacademic.nic.in/web_material/ValueEdu/Value%20Education%20Kits.pdf |
| 3 | https://www.verywellmind.com/personality-development-2795425 |
| 4 | https://trudreadz.com/2019/09/10/blind-faith-in-religion-destroys-our-ability-to-critically-think-for-ourselves/ |

## CO-PO Mapping

### Programme Outcomes (PO)

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|
| CO1 | 2 | | — | | 1 | 2 |
| CO2 | 1 | | 1 | | | 2 |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High. Each CO of the course must map to at least one PO.

## Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

# Walchand College of Engineering, Sangli
*(Government Aided Autonomous Institute)*
## AY 2023-24
### Course Information

| | |
|---|---|
| **Programme** | M. Tech. (Control System Engineering) |
| **Class, Semester** | Second Year M. Tech., Sem II |
| **Course Code** | 6CS691 |
| **Course Name** | Dissertation Phase IV |
| **Desired Requisites:** | Concept knowledge of research methodology, project management, Electrical Engineering |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| **Practical** | 10 Hrs/ Week | **MSE/LA1** | **ISE/LA2** | **ESE** | **Total** |
| **Interaction** | | 100 | | | 100 |
| | | **Credits: 5** | | | |

### Course Objectives

| | |
|---|---|
| 1 | To develop the student to apply the knowledge gained to identify problems for research and provide the solutions by self-study and interaction with stakeholders. |
| 2 | Acquire knowledge to tackle real world problems of societal concerns |
| 3 | Impart flexibility to the student to have increased control over his/ her learning |
| 4 | Teachers would serve as mentor/facilitator of inquiry and reflection rather than as an instructor |
| 5 | Enhance a students' learning through increased interaction with peers and colleagues. |

### Course Outcomes (CO) with Bloom's Taxonomy Level

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

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| CO1 | **Search** the existing literature and identification of research problem | IV | Analyze |
| CO2 | **Design and develop** the solution for complex engineering problem | V | Evaluate |
| CO3 | **Create** the new knowledge in the specialized field | VI | Create |

### List of Experiments / Lab Activities/Topics

ISE for dissertation phase IV is based on the efforts by the student for synopsis preparation. It shall be evaluated using the parameters extent of literature review, scope defined, objectives, and fundamental concepts, quality of presentation, and interaction during presentation, effort/work done, quality of report and interaction with guide.

### Textbooks

| | |
|---|---|
| 1 | As per the research topic |

### References

| | |
|---|---|
| 1 | National and International Journals |

### Useful Links

| | |
|---|---|
| 1 | https://nptel.ac.in/courses/121/106/121106007/ |
| 2 | https://www.youtube.com/watch?v=mAVswCbz_jM&feature=emb_imp_woyt |
| 3 | https://nptel.ac.in/courses/110/104/110104073/ |
| 4 | https://nptel.ac.in/courses/110/107/110107081/ |

## CO-PO Mapping

| | Programme Outcomes (PO) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| CO1 | 1 | | | 1 | | 2 |
| CO2 | 1 | | 1 | | 2 | 1 |
| CO3 | | 2 | | | | 1 |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

# Walchand College of Engineering, Sangli
*(Government Aided Autonomous Institute)*

## AY 2023-24

### Course Information

| | |
|---|---|
| **Programme** | M. Tech. (Control System Engineering) |
| **Class, Semester** | Second Year M. Tech., Sem II |
| **Course Code** | 6CS692 |
| **Course Name** | Dissertation Phase V |
| **Desired Requisites:** | Concept knowledge of research methodology, project management, Electrical Engineering |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| **Practical** | 10 Hrs/ Week | **MSE/LA1** | **ISE/LA2** | **ESE** | **Total** |
| **Interaction** | | | 100 | | 100 |
| | | | Credits: 5 | | |

### Course Objectives

| | |
|---|---|
| 1 | To develop the student to apply the knowledge gained to identify problems for research and provide the solutions by self-study and interaction with stakeholders. |
| 2 | Acquire knowledge to tackle real world problems of societal concerns |
| 3 | Impart flexibility to the student to have increased control over his/ her learning |
| 4 | Teachers would serve as mentor/facilitator of inquiry and reflection rather than as an instructor |
| 5 | Enhance a students' learning through increased interaction with peers and colleagues. |

### Course Outcomes (CO) with Bloom's Taxonomy Level

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

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| CO1 | **Search** the existing literature and identification of research problem | IV | Analyze |
| CO2 | **Design and develop** the solution for complex engineering problem | V | Evaluate |
| CO3 | **Create** the new knowledge in the specialized field | VI | Create |

### List of Experiments / Lab Activities/Topics

ISE for dissertation phase V is based on the progress made during the semester for the objectives defined in the synopsis and the report submitted by the students. It shall be evaluated through progress seminar(s) at the end of the semester. The parameters for evaluation include extent of work done, results and discussion/publication efforts, quality of presentation, quality of report, interaction during presentation and interaction with guide. ISE shall be conducted by Dissertation Evaluation Committee (DEC).

### Textbooks

| | |
|---|---|
| 1 | As per the research topic |

### References

| | |
|---|---|
| 1 | National and International Journals |

## Useful Links

| | |
|---|---|
| 1 | https://nptel.ac.in/courses/121/106/121106007/ |
| 2 | https://www.youtube.com/watch?v=mAVswCbz_jM&feature=emb_imp_woyt |
| 3 | https://nptel.ac.in/courses/110/104/110104073/ |
| 4 | https://nptel.ac.in/courses/110/107/110107081/ |

## CO-PO Mapping

| | Programme Outcomes (PO) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| CO1 | 1 | | | 1 | | 2 |
| CO2 | 1 | | 1 | | 2 | 1 |
| CO3 | | 2 | | | | 1 |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

# Walchand College of Engineering, Sangli
*(Government Aided Autonomous Institute)*
## AY 2023-24
### Course Information

| Programme | M. Tech. (Control System Engineering) |
|---|---|
| Class, Semester | Second Year M. Tech., Sem II |
| Course Code | 6CS693 |
| Course Name | Dissertation Phase VI |
| Desired Requisites: | Concept knowledge of research methodology, project management, Electrical Engineering |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| Practical Interaction | 12 Hrs/ Week | MSE/LA1 | ISE/LA2 | ESE | Total |
| | | | | 100 | 100 |
| | | Credits: 6 | | | |

### Course Objectives

| 1 | To develop the student to apply the knowledge gained to identify problems for research and provide the solutions by self-study and interaction with stakeholders. |
|---|---|
| 2 | Acquire knowledge to tackle real world problems of societal concerns |
| 3 | Impart flexibility to the student to have increased control over his/ her learning |
| 4 | Teachers would serve as mentor/facilitator of inquiry and reflection rather than as an instructor |
| 5 | Enhance a students' learning through increased interaction with peers and colleagues. |

### Course Outcomes (CO) with Bloom's Taxonomy Level

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

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| CO1 | **Search** the existing literature and identification of research problem | IV | Analyze |
| CO2 | **Design and develop** the solution for complex engineering problem | V | Evaluate |
| CO3 | **Create** the new knowledge in the specialized field | VI | Create |

### List of Experiments / Lab Activities/Topics

ESE for dissertation phase VI shall be conducted at the end of semester by a duly constituted examination panel composed of Chairman, internal examiner (guide) and external examiner.

### Textbooks

| 1 | As per the research topic |
|---|---|

### References

| 1 | National and International Journals |
|---|---|

### Useful Links

| 1 | https://nptel.ac.in/courses/121/106/121106007/ |
|---|---|
| 2 | https://www.youtube.com/watch?v=mAVswCbz_jM&feature=emb_imp_woyt |
| 3 | https://nptel.ac.in/courses/110/104/110104073/ |
| 4 | https://nptel.ac.in/courses/110/107/110107081/ |

## CO-PO Mapping

| | Programme Outcomes (PO) | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | 1 | 2 | 3 | 4 | 5 | 6 |
| CO1 | 1 | | | 1 | | 2 |
| CO2 | 1 | | 1 | | 2 | 1 |
| CO3 | | 2 | | | | 1 |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

# Walchand College of Engineering, Sangli
*(Government Aided Autonomous Institute)*

## AY 2023-24

### Course Information

| | |
|---|---|
| Programme | M. Tech. (Control System Engineering) |
| Class, Semester | Second Year M. Tech., Sem II |
| Course Code | 6CS694 |
| Course Name | Techno-Socio Activity |
| Desired Requisites: | — — |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| Practical | | LA1 | LA2 | Lab ESE | Total |
| Interaction | 1 Hrs/ Week | 30 | 30 | 40 | 100 |
| | | Credits: 1 | | | |

### Course Objectives

| 1 | To record student performance in co-curricular and extra-curricular activities over two years will be considered. |
|---|---|
| 2 | To encourage the students to participate in activities that help develop leadership skills, team integrity, coordination skills, Time management, Communications skills, Interviewing skills etc. |
| 3 | To highlight importance of social responsibility. |

### Course Outcomes (CO) with Bloom's Taxonomy Level

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

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| CO1 | **Notice** an improvement in his/her understanding and presentation skills. | III | Apply |
| CO2 | **Understand** and value the importance of working in a diversified team. | IV | Analyze |
| CO3 | **Demonstrate** the soft skills like presentation skills, technical report writing etc. | V | Evaluate |

### List of Experiments / Lab Activities/Topics

The guide will be mentoring a given student batch for the duration of two years. The students shall submit proof of their achievements in various extra and co-curricular activities related to technical, cultural and social causes from first year to second year. The faculty will evaluate the students' performance at the end of 4th semester, based on the rubrics provided by the department from time to time.

### Textbooks

| 1 | NA |
|---|---|

### References

| 1 | NA |
|---|---|

### Useful Links

| 1 | NA |
|---|---|

## CO-PO Mapping

| | Programme Outcomes (PO) | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| CO1 | 2 | | | | 3 | |
| CO2 | | 1 | | | 2 | |
| CO3 | | | 2 | | 3 | |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High
Each CO of the course must map to at least one PO.

## Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

| Assessment | Based on | Conducted by | Typical Schedule | Marks |
|---|---|---|---|---|
| LA1 | Lab activities, attendance, journal | Lab Course Faculty | During Week 1 to Week 8 Marks Submission at the end of Week 8 | 30 |
| LA2 | Lab activities, attendance, journal | Lab Course Faculty | During Week 9 to Week 16 Marks Submission at the end of Week 16 | 30 |
| Lab ESE | Lab activities, journal/ performance | Lab Course Faculty and External Examiner as applicable | During Week 18 to Week 19 Marks Submission at the end of Week 19 | 40 |

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

# AICTE Mandatory Courses

### Course Information

| | |
|---|---|
| Programme | M. Tech. (Control System Engineering) |
| Class, Semester | First Year M. Tech., Sem I |
| Course Code | 6IC602 |
| Course Name | Constitution of India |
| Desired Requisites: | |

| Teaching Scheme | | Examination Scheme (Marks) | | | |
|---|---|---|---|---|---|
| Lecture | 2 Hrs/week | MSE | ISE | ESE | Total |
| Tutorial | | 30 | 20 | 50 | 100 |
| | | Credits: 0 | | | |

### Course Objectives

| 1 | To review and create awareness on various provisions in the constitution of India. |
|---|---|

### Course Outcomes (CO) with Bloom's Taxonomy Level

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

| CO | Course Outcome Statement/s | Bloom's Taxonomy Level | Bloom's Taxonomy Description |
|---|---|---|---|
| CO1 | **Explain** the premises informing the twin themes of liberty and freedom from a civil rights perspective. | II | Understanding |
| CO2 | **Address** the growth of Indian opinion regarding modern Indian intellectuals constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism | II | Understanding |
| CO3 | **Address** the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution | II | Understanding |

| Module | Module Contents | Hours |
|---|---|---|
| I | History of Making of the Indian Constitution Drafting Committee, (Composition & Working | 4 |
| II | **Philosophy of the Indian Constitution :** Preamble, Salient Feature | 4 |
| III | **Contours of Constitutional Rights:** Fundamental Rights; Right to Equality; Right to Freedom; Right against Exploitation; Right to Freedom of Religion; Cultural and Educational Rights; Right to Constitutional Remedies; Directive Principles of State Policy; Fundamental Duties. | 5 |
| IV | **Organs of Governance:** Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions | 5 |
| V | **Local Administration:** District''s Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy | 5 |

Course Contents for MTech Programme, Department of Electrical Engineering, AY2023-24

| | Election Commission: | |
|---|---|---|
| VI | Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women. | 5 |

| Textbooks | |
|---|---|
| 1 | Dr. S. N. Busi, Dr. B. R. Ambedkar *"Framing of Indian Constitution"*, 1st Edition, 2015. |
| 2 | M. P. Jain, *"Indian Constitution Law"*, 7th Edn., Lexis Nexis, 2014 |
| 3 | D.D. Basu, *"Introduction to the Constitution of India"*, Lexis Nexis, 2015 |

| References | |
|---|---|
| 1 | The Constitution of India, 1950 (Bare Act), Government Publication |

| Useful Links | |
|---|---|
| 1 | https://en.wikipedia.org/wiki/Constituent_Assembly_of_India |
| 2 | https://nptel.ac.in/courses/129/106/129106003/ |
| 3 | https://nptel.ac.in/noc/courses/noc20/SEM2/noc20-lw02/ |
| 4 | https://eci.gov.in/about/about-eci/the-functions-electoral-system-of-india-r2/ |

## CO-PO Mapping

| | Programme Outcomes (PO) | | | | | |
|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
| CO1 | | | 1 | | | |
| CO2 | 2 | | | | | |
| CO3 | | | | 1 | | 2 |

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High. Each CO of the course must map to at least one PO.

## Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)