SHIVAJI UNIVERSITY, KOLHAPUR
416 004, MAHARASHTRA
PHONE : EPABX – 2609000, BOS Section – 0231-2609094, 2609487
Web : www.unishivaji.ac.in Email: bos@unishivaji.ac.in
शिवाजी विद्यापीठ, कोल्हापूर ४१६ ००४, महाराष्ट्र
दूरध्वनी - इपीबीएक्स - २०६०९०००, अभ्यासमंडळे विभाग : ०२३१- २६०९०९४. २६०९४८७
वेबसाईट : www.unishivaji.ac.in ईमेल : bos@unishivaji.ac.in

Estd. 1962
"A++" Accredited by NAAC (2021)
With CGPA 3.52

SU/BOS/Sci & Tech/ 183 **Date: 10/06/2026**

The Principal / Director,
All Concerned Affiliated Colleges / Institutions,
Shivaji University, Kolhapur.

Subject: Regarding revised syllabus of **B. Tech.** degree **Programme (Affiliated Colleges)** under the Faculty of Science and Technology as per NEP 2020.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, Nature of Question paper and equivalence of B. Tech. degree programme under the Faculty of Science & Technology as per National Education Policy 2020 (NEP 2020).

Sr. No.	B. Tech Course Syllabus	
1	Civil Engineering	Part-III
2	Mechanical Engineering	Part-III
3	Mechanical and Mechatronic Engineering (Additive Manufacturing)	Part-III
4	Electrical Engineering	Part-III
5	Electrical and Computer Engineering	Part-III
6	Electronics and Telecommunication Engineering	Part-III
7	Electronics & Computer Science Engineering	Part-III
8	Computer Science and Engineering	Part-III
9	Computer Science and Engineering (Artificial Intelligence & Machine Learning) (AIML)	Part-III
10	Computer Science and Engineering (Data Science) (DS)	Part-III
11	Computer Science and Engineering (Artificial Intelligence & Data Science) (AIDS)	Part-III
12	Electronics and communication Engineering (Bio-Medical Engineering)	Part-II

This Syllabus, nature of question and equivalence shall be implemented from the academic year **2026-27** onwards. A soft copy containing the syllabus is attached herewith and it is available on university website **www.unishivaji.ac.in>Syllabus>Syllabus as per NEP-2020.**

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October/ November 2026 & March / April 2027. These chances are available for repeater students, if any

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dy. Registrar

Copy to: for Information and necessary action

1	The I/c Dean, Faculty of Science & Technology	7	Appointment A & B Section
2	Director, Board of Examinations & Evaluation	8	Affiliation (T.1) (T.2) Section
3	The Chairperson, Respective Board of Studies	9	P.G.Admission Section,
4	Other Exam 4 Section,	10	P.G Seminar Section
5	Eligibility Section,	11	Computer Centre/ IT Cell
6	Internal Quality Assurance Cell (IQAC)		

Shivaji University Kolhapur

Revised Syllabus as per
National Education Policy -2020

T. Y. B. Tech.
Electrical and Computer Engineering

To be implemented from

Academic Year 2026-27

SHIVAJI UNIVERSITY, KOLHAPUR

NANE OF FACULTY: SCIENCE AND TECHNOLOGY

PROGRAMME NAME AND CODE: ELECTRICAL & COMPUTER ENGINEERING

PART: THREE

Preamble

The Third Year B. Tech. Electrical and Computer Engineering Curriculum of Shivaji University is designed to equip students with strong theoretical knowledge, practical skills, and emerging technological competencies required in modern electrical, electronics, automation, and computing industries. The curriculum emphasizes the integration of core Electrical and Computer Engineering principles with advanced technologies such as Artificial Intelligence (AI), Machine Learning (ML), Internet of Things (IoT), Embedded Systems, Industrial Automation, Smart Grid Technologies, and Data Analytics to meet the evolving demands of Industry 4.0.

The curriculum provides a balanced blend of electrical engineering, computer engineering, power systems, control systems, embedded systems, digital electronics, microcontrollers, communication systems, computer programming, data structures, and intelligent automation. Courses covering Electrical Machines, Power Electronics, Power System Analysis, Control Engineering, Microprocessors and Microcontrollers, Embedded Systems, Computer Networks, and Industrial Automation strengthen students' analytical, computational, and problem-solving abilities while developing a strong engineering foundation. Laboratory courses and project work promote experiential learning, hands-on practice, innovation, teamwork, and industry-oriented skill development.

Special emphasis has been given to multidisciplinary learning and emerging technologies through programme electives and minor courses in areas such as Artificial Intelligence, Machine Learning, Internet of Things (IoT), Electric Vehicles (EV), Renewable Energy Systems, Smart Grid Technologies, Industrial Robotics, Cyber-Physical Systems, Edge Computing, and Advanced Embedded Systems. These subjects prepare students to address real-world engineering challenges related to intelligent automation, sustainable energy, digital transformation, smart manufacturing, predictive maintenance, and connected systems.

The curriculum also highlights the growing role of AI and ML across electrical and computer engineering applications. Students are introduced to intelligent control systems, predictive analytics, fault diagnosis, computer vision, data-driven optimization, energy forecasting, cybersecurity, and smart monitoring techniques that enhance engineering decision-making, operational efficiency, and system reliability.

In addition, the programme encourages innovation, research, entrepreneurship, and interdisciplinary collaboration through laboratory experiments, mini-projects, industrial visits, internships, and project-based learning. Students gain practical exposure to modern engineering tools, simulation software, hardware platforms, and industrial practices, enabling them to develop professional competencies required for higher education, research, product development, and employment in diverse sectors.

The curriculum is designed in accordance with the principles of Outcome-Based Education (OBE), fostering critical thinking, creativity, communication skills, ethical values, environmental consciousness, leadership qualities, and lifelong learning. It prepares graduates to adapt to rapidly evolving technologies while contributing effectively to society through sustainable engineering solutions.

Overall, this syllabus aims to develop competent, innovative, and socially responsible Electrical and Computer Engineers capable of designing intelligent systems, advancing technological innovation, supporting industrial growth, and contributing to sustainable development at national and global levels.

Program Learning Outcomes (PLOs) / Program Outcomes (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, science, computing, and Electrical & Computer Engineering including analog and digital electronics, electrical circuits, electrical machines, control systems, power systems, embedded systems, IoT, AI & ML, renewable energy, EVs, and automation to solve complex engineering problems.

PO2: Problem Analysis: Identify, formulate, analyze, and solve complex electrical and computer engineering problems using appropriate engineering principles, research, and computational techniques.

PO3: Design/Development of Solutions: Design innovative, sustainable, and reliable electrical, embedded, IoT, automation, renewable energy, and electric vehicle systems considering safety, environmental, and societal needs.

PO4: Investigation: Conduct experiments, simulations, modeling, and data analysis to investigate and validate engineering solutions.

PO5: Engineering Tool Usage: Apply modern engineering, programming, simulation, AI, embedded, and IT tools to design, analyze, and optimize engineering systems.

PO6: Engineer and Society: Develop engineering solutions considering sustainability, energy efficiency, safety, legal, environmental, and societal responsibilities.

PO7: Ethics: Apply professional ethics, engineering standards, and social responsibility in engineering practice.

PO8: Teamwork: Work effectively as an individual and as a member or leader in multidisciplinary teams.

PO9: Communication: Communicate technical information effectively through reports, presentations, and documentation.

PO10: Project Management and Finance: Apply engineering management, entrepreneurship, project planning, and economic principles in multidisciplinary projects.

PO11: Life-Long Learning: Engage in lifelong learning and continuously adapt to emerging technologies such as AI, IoT, automation, renewable energy, embedded systems, and electric vehicles.

Program Educational Objectives (PEOs)

PEO1: **Professional Competence**

Graduates will apply knowledge of Electrical and Computer Engineering to solve real-world engineering problems and build successful careers in industry, research, higher education, or entrepreneurship.

PEO2: **Lifelong Learning and Innovation**

Graduates will continuously upgrade their knowledge and adapt to emerging technologies such as AI, IoT, embedded systems, automation, renewable energy, and electric vehicles.

PEO3: Ethics and Leadership

Graduates will demonstrate professional ethics, leadership, teamwork, communication skills, and social responsibility while contributing to sustainable engineering solutions.

Eligibility for Admission-

Eligibility for F.Y. B.Tech.

(First Year - Engineering or Technology (4 years duration))

(1) Maharashtra State Candidature Candidate.-

The candidate,-

(i) should be a citizen of India;

(ii) (ii) should have Passed 10+2 examination or its equivalent examination with Physics and Mathematics as compulsory subjects along with 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 or Electronics or Entrepreneurship and obtained at least forty five per cent marks (at least forty per cent marks, in case of Reserved categories, Economically Weaker Section and Persons with Disability candidates belonging to the Maharashtra State only) in the above subjects taken together and The Candidate should have appeared in all the subjects in PCM MHT-CET 2026 and obtained non zero score in PCM MHT-CET 2026 conducted by the Competent Authority; (There candidates are eligible to apply for all 29 major disciplines declared by AICTE)

Or

(iii) Should have passed 10+2 examination or its equivalent examination with Physics and Chemistry as compulsory subjects along with the Mathematics 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 or Electronics or Entrepreneurship as one of the subject and obtained at least forty five per cent marks (at least forty per cent marks, in case of Reserved categories, Economically Weaker Section and Persons with Disability candidates belonging to the Maharashtra State only) in the above subjects taken together and the candidate should have appeared in all the subjects in MHT-CET 2025 and obtained non zero score in Physics, Chemistry and Biology (PCB) MHT-CET 2025 conducted by the Competent Authority is eligible for admission to any of the following Courses under major disciplines declared by concerned Appropriate Authority or All India Council for Technical Education (AICTE), namely:- (a)Agriculture Engineering; (b)Biotechnology; (c)Food Engineering; (d)Leather Technology; (e)Packaging Technology; (f) Pharmaceutical Engineering; (g)Printing Engineering; (h)Fashion Technology; or (i) Textile Chemistry;

Or

(iv) Should have passed minimum three years Diploma in Engineering and Technology and obtained at least forty five per cent marks (at least forty per cent marks, in case of Reserved categories, Economically Weaker Section and Persons with Disability candidates belonging to the Maharashtra State only) ;

Or

(v) Passed three years Diploma of Vocation (D. Voc.) stream in the same or allied sector;

Eligibility for Direct Second Year B.Tech.

(Direct Second Year (Lateral Entry)- Engineering /Technology (3 Years duration)

The candidate,-
should be a citizen of India;
should have passed minimum three years or two years (Lateral Entry) Diploma Course in Engineering and Technology with at least forty five per cent. marks (at least forty per cent. marks in case of Candidates of Reserved categories, Economically Weaker Section and Persons with Disability category belonging to Maharashtra State) in any branch of Engineering and Technology from an All India Council for Technical Education (AICTE) or Central Government or State Government approved Institution or its equivalent;

Or

should have passed B.Sc. Degree from a University Grants Commission (UGC) or Association of Indian Universities recognized University with at least forty five per cent. marks (at least forty per cent. marks in case of candidates of Reserved categories, Economically Weaker Section and Persons with Disability category belonging to Maharashtra State) and passed HSC or its equivalent examination with Mathematics as a subject;

Or

should have passed three years D. Voc. Stream in the same or allied sector;
and Any other eligibility criteria and requirement declared from time to time by the appropriate authority as defined under the Act.

STANDARD OF PASSING AND DETERMINATION OF SGPA/CGPA, GRADING AND DECLARATION OF RESULTS

Passing criteria:

1. Passing with 40% marks is mandatory in ESE theory. The duration of ESE theory examination will be 02:30 Hrs. For Engineering Graphics subject of F. Y. B. Tech, it will be of 03:00 Hrs. Combined passing marks (MSE+ISE/CA+ESE) for theory course are 40%.
2. MSE will be based on 50% syllabus from beginning (First Three Units).
3. No compulsory passing for MSE.
4. Compulsory passing percentage for ISE/CA of theory and practical is 40%.
5. Compulsory passing percentage for ESE practical / oral examination 40%.
6. Student should clear all first year passing heads before admits to third year and clear all second year passing heads before admits to fourth year.
7. Aggregate of a particular year (both the semesters) shall considered as a separate head of passing for the result of that concerned year and 45 % aggregate score is mandatory. The student not fulfilling this criterion can improve the score of 45% aggregate through appearing in re-examination for maximum of three theory courses.
8. If student fails to improve the score of 45% aggregate through appearing in re-examination then he/she can improve the score of 45% aggregate by re-appearing in subsequent concern odd semesters (3, 5, 7) or concern even semesters (4, 6, 8) ESE of theory course examination in next academic year.

The Semester Grade Point Average (SGPA) shall be calculated for each semester and Cumulative Grade Point Average (CGPA) shall be calculated at the end of all semesters.
The standard of passing shall be in accordance with the following table :

Marks Obtained	Numerical Grade (Grade Point)		CGPA	Letter Grade
Absent	0 (zero)		-	-
0 – 39	0 (zero)		0.0 – 4.99	F (Fail)
40 – 49	5		5.00 – 5.49	C
50 – 59	6		5.50 – 6.49	B
60 – 69	7		6.50 – 7.49	B+
70 – 79	8		7.50 – 8.49	A
80 – 89	9		8.50 – 9.49	A+
90 – 100	10		9.50 – 10.0	O (Outstanding)

Note :
The award of the final Grade for the degree of B. Tech. shall be calculated based on CGPA.

Calculation of SGPA and CGPA:

1. Semester Grade Point Average **(SGPA)**

$$\mathbf{SGPA} = \frac{\sum(\text{Course credits} \times \text{Grade points obtained}) \text{ of a Semester}}{\sum(\text{Course credits}) \text{ of respective Semester}}$$

2. Cumulative Grade Point Average **(CGPA)**

$$\mathbf{CGPA} = \frac{\sum(\text{Total credits of a Semester} \times \text{SGPA of respective Semester}) \text{ of all Semesters}}{\sum(\text{Total course credits}) \text{ of all Semesters}}$$

1. Marks obtained > = 0.5 shall be rounded off to next higher digit.
2. The SGPA & CGPA shall be rounded off to 2 decimal points.
3. CGPA will be calculated cumulatively from Sem. I to Sem. VIII for regular students and from Sem. III to Sem. VIII for lateral entry students.

Note: An equivalent certificate of CGPA to percentage of marks will be provided to student on candidate's demand after remitting prescribed fees by Shivaji University.

Awards of Grades for Re-Examination:

1. There will be Re-examination for all failure ESE theory/practical courses in a year after even semester immediately the result declaration of ESE and before the commencement of next academic year.
2. A student will apply for re-examination before the last date of such application and will appear for re-examination.
3. In such cases In Semester Examination performance of a student will not be wiped out.
4. The weightage similar to ESE will be given to re-examination.
5. A student who is eligible for re-examination but remains absent for re-examination will be given grade 'Absent'.
6. If the student fails in an odd semesters (1, 3, 5, 7) and/or even semesters (2, 4, 6, 8) in ESE of theory/practical credit course in an academic year shall be allowed to appear for re-examination.
7. There will be ESE examination of theory and practical courses of semester 1, 3, 5 and 7 at the end of odd semester, there will be ESE examination of theory and practical courses of semester 2, 4, 6 and 8 at the end of even semester and there will be re-examination for all ESE theory and practical courses from semester 1 to semester 8 after one month of declaration of result of even semester.

8. If the student fails to clear the ESE of theory/practical course even in re-examination conducted after even semesters (2, 4, 6, 8) in a year, he/she shall have to re-appear in subsequent concern odd semesters (3, 5, 7) or concern even semesters (4, 6, 8) ESE of theory/practical credit course examination in next academic year for the failed ESE of theory/practical credit course examination of concern odd semester or concern even semester that she/he has failed in previous academic year.
9. The candidate can apply for revaluation of photocopy of re-examination for ESE of theory/practical course conducted after even semesters (2, 4, 6, 8).
10. A student will be awarded a grade given in Table of **R. R. B. Tech. 9** depending upon the cumulative marks obtained by him/her in Re-examination.

Shivaji University, Kolhapur

T.Y.B.Tech. (NEP2.0 Pattern)

Question Paper Patten

Question Number	Chapter	Marks	Total Marks	Details
Q.No.01	01,02,03	05	15	Solve any 03 out of 04
Q. No. 02	04	05	15	Solve any 03 out of 04
Q. No. 03	05	05	15	Solve any 03 out of 04
Q. No. 04	06	05	15	Solve any 03 out of 04

Q.1 Solve any Three (5*3)=15 Marks
a)
b)
c)
d)
Q.2 Solve any Three (5*3)=15 Marks
a)
b)
c)
d)
Q.3 Solve any Three (5*3)=15 Marks
a)
b)
c)
d)
Q.4 Solve any Three (5*3)=15 Marks
a)
b)
c)
d)

Second Year Exit: Teaching Methodology, Assessment and Evaluation

[I] As per R. R. B. Tech. 12.2 Rule: Award of Degree

If a student passes all the courses of first year, second year and earns the requisite number of credits, the student will become entitled to Undergraduate Diploma (Two years or four semesters) in the programme of his/her major subject. If he/she wants to exit, can exit the programme with UG Diploma certificate. However, for the award of two years UG Diploma Certificate in Major with 88 credits, an additional 8 credits from Exit Courses are required to earn.

[II] Second Year Exit Course:

Methodology 1:

1. The students should complete two online certification courses (NPTEL) related to their programme, each of 3 credits. In addition to this, they will also need to complete 2 credits worth of two Virtual Lab work related to online certification courses. These additional 8 credits earn by students shall be based upon skill based vocational courses or internship/Apprenticeship.

2. The NPTEL courses are likely to be available online and can be completed at the student's own pace. The content will be specific to the student's field of study or programme. The skill based vocational courses shall be analogous to the Baskets/Areas provided by the concerned BoS.

3. The student must complete two virtual lab work that adds 2 credits to simulate practical or experimental learning experiences in a controlled virtual environment.

4. **Examination scheme:** The marks gained from the two NPTEL Courses (3 credits each) are converted to a total of 100 marks. The report for the two Virtual Lab work of 2 credits will be

evaluated for 25 marks. The report should include a detailed write-up and analysis of the virtual lab experiments conducted, encompassing the methodology, results, and conclusions.

5. There may be uncertainty in availability of the NPTEL courses offered by concerned BoS as there is continuous updatation of the NPTEL courses. The students can choose equivalent NPTEL course of the required duration with prior permission from the concerned institute. The concerned institute should communicate to Concerned BoS for their permission. For NPTEL course registration, the students are required to visit to website https://swayam.gov.in and create their account. Log in the account and join the required course and follow the instructions to compete the course. Similarly, for Virual Lab, the students are required to visit to website https://www.vlab.co.in and create their account. Log in the account and join the required lab and follow the instructions to compete the course (need to perform all listed experiments under that Lab). To fulfill the requirement of 06 credits, students can go for two courses each of 12 weeks.

Methodology 2:

1. The students should complete two online certification courses (NPTEL) related to their programme, each carrying 2 credits. In addition to this, they will also need to complete 4 credits worth of two physical internship/Apprenticeship (each of 40 hrs) work from relevant industry. These additional 8 credits earned by the students shall be based upon skill based vocational courses or internship/Apprenticeship.

2. The NPTEL courses are likely to be available online and can be completed at the student's own pace. The content will be specific to the student's field of study/programme. The skill-based vocational courses shall be analogous with the list provided by the concerned BoS.

3. The student should complete two physical internship/Apprenticeship (each of 40 hrs) work from relevant industrial practices that adds 4 credits to simulate practical or experimental learning experiences in a controlled virtual environment.

4. **Examination scheme:** The marks gained from the two NPTEL Courses (2 credits each) are converted to a total of 100 marks. The report for the performed two physical internship/Apprenticeship (each of 40 hrs) work from relevant industrial practices of 4 credits will be evaluated for 25 marks. The report should include a detailed write-up and analysis of two physical internship/Apprenticeship (each of 40 hrs) work along with certificate of internship/Apprenticeship from relevant industrial practices conducted, encompassing the methodology, results, and conclusions.

5. There may be uncertainty in availability of the NPTEL courses offered by concerned BoS as there is continuous updatation of the NPTEL courses. The students can choose equivalent NPTEL course of the required duration with prior permission from the concerned institute. The concerned institute should communicate to Concerned BoS for their permission. For NPTEL course registration, the students are required to visit to website https://swayam.gov.in and create their account. Log in the account and join the required course and follow the instructions to compete the course.

Guidelines for Open Elective Courses: Teaching Methodology, Assessment and Evaluation

Open Elective (OE) courses other than faculty of Science and Technology through Massive Open Online Courses (MOOCs) allowing students to engage with a broad spectrum of ideas and knowledge areas. The OE courses are likely to be available online and can be completed at the student's own pace within a set timeframe. For OE course, students are required to visit to the website https://swayam.gov.in for registration and create an account. Afterward, students should Login the account and join the course assigned by the course coordinator and follow the instructions to compete the course through self-learning mode. Additionally, the respective institution should download the relevant study materials to ensure students have access to them as needed. Minimum 25 students can register for one OE course in the concerned institute. There will be one course coordinator for one OE course. Students need to cover OE Courses of 08 credits. These 08 credits over semesters III to V. OE courses are chosen from faculty other than Faculty of Science and Technology. It is offered in Second and Third year as per Semester wise credit distribution table. Students need to take up the courses of 08 credits over semesters III to V.

1. **For Semester-III,** OE theory course of 3 credits consists of Mid Semester Examination (MSE) of 30 Marks, In Semester Evaluation/Continuous Assessment (ISE/CA) of 10 Marks and End Semester Examination (ESE) of 60 Marks.
2. **For Semester-III,** OE practical lab course of 1 credit consists of In Semester Evaluation/Continuous Assessment (ISE/CA) of 25 Marks

and End Semester Examination-Practical Oral Examination (ESE-POE) of 25 Marks. Course Coordinator assigned by Institute should complete the selected course practical through expert of that course. The lab exercises and demonstrations prepared by concern expert must be aligned with the specific OE course that the students have chosen.

3. **For Semester-IV,** OE theory course of 2 credits consists of Mid Semester Examination (MSE) of 30 Marks, In Semester Evaluation/Continuous Assessment (ISE/CA) of 10 Marks and End Semester Examination (ESE) of 60 Marks.
4. **For Semester-V,** OE theory course of 2 credits consists of Mid Semester Examination (MSE) of 30 Marks, In Semester Evaluation/Continuous Assessment (ISE/CA) of 10 Marks and End Semester Examination (ESE) of 60 Marks.
5. The Mid Semester Examination (MSE) of 30 Marks based on selected OE Course will be conducted by Concerned Departmental Course Coordinator. The course expert of concerned faculty should set question paper of MSE and evaluate the same.
6. Online submitted assignments by students using SWAYAM platform for concerned OE course will be used for In Semester Evaluation/Continuous Assessment (ISE/CA) of 10 Marks by Concerned Departmental Course Coordinator appointed for particular course by Principal of the Institute. Assignments may be of varied in nature for OE course.
7. The ESE of OE courses will be conducted by the University. The setting of question papers for both MSE and ESE, as well as the evaluation of the concerned OE course, should be carried out by the

course expert from the Board of Studies (BoS) of the respective faculty in accordance with the provisions under Panel of Paper Setters, Examiners, and Moderators – Clauses 41(f) and 48(3)(a).

8. MSE will be based on 50% syllabus from beginning (First 50% Weeks).
9. ESE paper setting weightage will be 25% on syllabus covered for MSE (First 50% Weeks) and 75% on remaining syllabus (Last 50% Weeks). The number of optional questions marks in a theory paper shall be 25 to 30 percent of the maximum marks.

Note: One OE course may be floated by the institute for 60 intake.

Open Electives Courses Offered to the students under Faculty of Science and Technology

In line with New Education Policy 2020

(Effective from Academic year 2025-26)

Open Electives

The students need to cover Open Elective Courses (OE) of 08 credits. These 08 credits over semesters III to V.

Semester wise credit distribution table for OE is given below

Sr. No.	Semester	Open Elective	Teaching scheme			Credits
			L	T	P	
01	III	OE-01	3	-	-	3
	III	OE-01 Lab	-	-	2	1
	IV	OE-02	2	-	-	2
02	V	OE-03	2	-	-	2
	Total		**7**	**-**	**2**	**8**

Semester wise baskets of OE from faculty other than Faculty of Science and Technology, Viz. Faculty of Commerce and Management, Faculty of Humanities and Faculty of Interdisciplinary Studies is given below

List of Open Elective Courses might be taken by students under Faculty of Science and Technology

Semester – III

Note: Choose any one course from the below basket of other than faculty in such way that the course with same name should not comes under or taught by major programme or the MDM.

Sr. No.	Name of the Course	Category	Duration (Weeks)	Credit Points	Institute Offering Course	Name of Professor/ Resource person	Link
01	Principles of Economics	Economics	12	03	IIT Madras	Prof. Sabuj Kumar Mandal	https://onlinecourses.nptel.ac.in/noc25_ec15/preview
02	German – I	Humanities and Social Science	12	03	IIT Madras	Prof. Milind Brahme	https://onlinecourses.nptel.ac.in/noc25_hs121/preview
03	Science, Technology and Society	Humanities and Social Science	12	03	IIT Guwahati	Prof. Sambit Mallick	https://onlinecourses.nptel.ac.in/noc25_hs189/preview
04	Environment and Development	Humanities and Social Science	12	03	IIT Guwahati	Prof. Ngamjahao Kipgen	https://onlinecourses.nptel.ac.in/noc25_hs195/preview
05	Logistics & Supply Chain Management	Humanities and Social Science	12	03	IIT Kharagpur	Prof. Vikas Thakur	https://onlinecourses.nptel.ac.in/noc25_hs205/preview
06	Introduction to Film Studies	Humanities and Social Sciences English studies	12	03	IIT Madras	Prof. Aysha Viswamohan	https://onlinecourses.nptel.ac.in/noc25_hs138/preview
07	Entrepreneurship	Management	12	03	IIT Madras	Prof. C Bhaktavatsala Rao	https://onlinecourses.nptel.ac.in/noc25_mg81/preview
08	Managerial Skills for Interpersonal Dynamics	Management	12	03	IIT Roorkee	Prof. Santosh Rangnekar	https://onlinecourses.nptel.ac.in/noc25_mg91/preview
09	Automation in Production Systems and Management	Management	12	03	IIT Kharagpur	Prof. Pradip Kumar Ray	https://onlinecourses.nptel.ac.in/noc25_mg135/preview
10	Numerical Methods for Engineers	Multidisciplinary	12	03	IIT Madras	Prof. Niket Kaisare	https://onlinecourses.nptel.ac.in/noc25_ge59/preview

Semester – IV

Note: Choose any one course from the below basket of other than faculty in such way that the course with same name should not comes under or taught by major programme or the MDM.

Sr. No.	Name of Course	Category	Duration (Weeks)	Credit Points	Institute Offering Course	Name of Professor/ Resource person	Link
01	Indian Business History	Humanities And Social Sciences	08	02	IIT Guwahati	Prof. Vipul Dutta	https://onlinecourses.nptel.ac.in/noc25_hs32/preview
02	Probability and Stochastic for Finance	Economic Sciences	08	02	IIT Kanpur	Prof. Joydeep Dutta	https://onlinecourses.nptel.ac.in/noc25_ma58/preview
03	Enhancing Soft Skills and Personality	Humanities and Social Sciences	08	02	IIT Kanpur	Prof. T. Ravichandran	https://onlinecourses.nptel.ac.in/noc25_hs87/preview
04	Mastering Speaking and Presentations: A case Based Approach	Humanities and Social Sciences	08	02	IIT Kharagpur	Prof. Seema Singh	https://onlinecourses.nptel.ac.in/noc25_hs96/preview
05	The Science of Happiness and Wellbeing	Humanities and Social Sciences	08	02	IIT Kharagpur	Prof. Priyadarshi Patnaik Prof. Manas K Mandal	https://onlinecourses.nptel.ac.in/noc25_hs103/preview
06	Philosophical Foundations Of Social Research	Humanities And Social Sciences	08	02	IIT Guwahati	Prof. Sambit Mallick	https://onlinecourses.nptel.ac.in/noc25_hs63/preview
07	Emotional Intelligence	Humanities and Social Science	08	02	IIT Kharagpur	Prof. Rabindra Kumar Pradhan	https://onlinecourses.nptel.ac.in/noc25_hs16/preview
08	Employment Communication: A Lab based course	Humanities and Social Science	08	02	IIT Kharagpur	Prof. Seema Singh	https://onlinecourses.nptel.ac.in/noc25_hs17/preview
09	Soft Skill Development	Humanities and Social Science	08	02	IIT Kharagpur	Prof. Priyadarshi Patnaik Prof. V. N. Giri Prof. D. Suar	https://onlinecourses.nptel.ac.in/noc25_hs72/preview
10	Social Behavior and the Brain: An Introduction to Social Neuroscience	Humanities and Social Science, Psychology, Neuroscience, Cognitive Science	08	02	IIT Kanpur	Prof. Ark Verma	https://onlinecourses.nptel.ac.in/noc25_hs101/preview
11	Economic Growth And Development	Humanities and Social Sciences	08	02	IIT Guwahati	Prof. Rajshree Bedamatta	https://onlinecourses.nptel.ac.in/noc25_hs11/preview

12	Effective Writing	Humanities and Social Sciences	08	02	IIT Roorkee	Prof. Binod Mishra	https://onlinecourses.nptel.ac.in/noc25_hs14/preview
13	Centre-State Relations in India	Law	08	02	IIT Kharagpur	Prof. Uday Shankar	https://onlinecourses.nptel.ac.in/noc25_lw04/preview
14	Foundation Course in Managerial Economics	Management	08	02	IIT Kharagpur	Prof. Barnali Nag	https://onlinecourses.nptel.ac.in/noc25_mg25/preview
15	International Marketing	Management	08	02	IIT Kharagpur	Prof. Biswarup Ghosh	https://onlinecourses.nptel.ac.in/noc25_mg32/preview
16	Introduction to System Dynamics Modeling	Management	08	02	IIT Bombay	Prof. Jayendran Venkateswaran	https://onlinecourses.nptel.ac.in/noc25_mg37/preview
17	Management of New Products and Services	Management	08	02	IIT Kharagpur	Prof. KBL Srivastava	https://onlinecourses.nptel.ac.in/noc25_mg44/preview
18	Business Forecasting	Management	08	02	IIT Bombay	Prof. Pankaj Dutta	https://onlinecourses.nptel.ac.in/noc25_mg66/preview
19	Yoga and Positive Psychology for Managing Career and Life	Management	08	02	IIT Bombay	Prof. Ashish Pandey	https://onlinecourses.nptel.ac.in/noc25_mg75/preview
20	Roadmap for patent creation	Multidisciplinary	08	02	IIT Kharagpur	Prof. Gouri Gargate	https://onlinecourses.nptel.ac.in/noc25_ge30/preview

Semester – V

Note: Choose any one course from the below basket of other than faculty in such way that the course with same name should not comes under or taught by major programme or the MDM.

Sr. No.	Name of Course	Category	Duration (Weeks)	Credit Points	Institute Offering Course	Name of Professor/ Resource person	Link
01	Enhancing Study Skills	Multidisciplinary	08	02	Indira Gandhi National Open University, New Delhi	Dr. P. Lakshmi; Dr. G. Mythili	https://onlinecourses.swayam2.ac.in/nou25_ge69/preview
02	Community Engagement and Social Responsibility	Multidisciplinary	10	02	Dayalbagh Educational Institute, Agra, Uttar Pradesh	Prof. Akshay Kumar Satsangi	https://onlinecourses.swayam2.ac.in/ugc25_ge10/preview
03	Economic Environment and Business Strategy	Economics	8	02	IIT Kanpur	Prof. Sukumar Vellakkal	https://onlinecourses.nptel.ac.in/noc25_ec16/preview
04	Corporate Social Responsibility	Management	8	02	IIT Kharagpur	Prof. Aradhna Malik	https://onlinecourses.nptel.ac.in/noc25_mg139/preview
05	Soft Skill Development	Humanities and Social Science	8	02	IIT Kharagpur	Prof. Priyadarshi Patnaik, Prof. V. N. Giri, Prof. D. Suar	https://onlinecourses.nptel.ac.in/noc25_hs142/preview
06	Developing Soft Skills and Personality	Humanities and Social Science	8	02	IIT Kanpur	Prof. T Ravichandran	https://onlinecourses.nptel.ac.in/noc25_hs174/preview
07	Introduction to Advanced Cognitive Processes	Humanities and Social Science	8	02	IIT Kanpur	Prof. Ark Verma	https://onlinecourses.nptel.ac.in/noc25_hs177/preview
08	Entrepreneurship and IP Strategy	Humanities and Social Science	8	02	IIT Kharagpur	Prof. Gouri Gargate	https://onlinecourses.nptel.ac.in/noc25_hs213/preview
09	Artificial Intelligence, Law and Justice	Law	8	02	NALSAR University of Law	Prof. Krishna Ravi Srinivas	https://onlinecourses.nptel.ac.in/noc25_lw12/preview
10	Innovation, Business Models and Entrepreneurship	Management	8	02	IIT Roorkee	Prof. Rajat Agrawal Prof. Vinay Sharma	https://onlinecourses.nptel.ac.in/noc25_mg95/preview
11	Organization Development and Change in 21st Century	Management	8	02	IIT Bombay	Prof. Ashish Pandey	https://onlinecourses.nptel.ac.in/noc25_mg103/preview

Guidelines for Multidisciplinary Minor (MDM) Programmes

As per the directives of the Government of Maharashtra, engineering colleges are encouraged to update their curricula in alignment with the guidelines of the National Education Policy (NEP) 2020. As part of this transformative initiative, the 'Minor Programme' has been introduced to promote multidisciplinary learning at the undergraduate level. These programmes are structured to provide students with interdisciplinary knowledge, enhancing their core academic disciplines and preparing them to meet the evolving demands of the global job market.

Minor programmes across various disciplines have been introduced to provide students with the opportunity to explore fields beyond their core B. Tech curriculum. These programmes enable students from specific branches to broaden their knowledge and skill sets. For example, a student pursuing Mechanical Engineering can opt for a Minor in Computer Science and Engineering, thereby acquiring interdisciplinary expertise that enhances both academic depth and professional flexibility. However, students enrolled in the Computer Science and Engineering (CSE) programme are restricted from choosing MDM's in Artificial Intelligence and Data Science, CSE (Data Science), and CSE (Artificial Intelligence and Machine Learning) in order to prevent overlap between the core curriculum of CSE and the content of these minors, ensuring that students gain diverse and non-redundant knowledge through their minor specializations. **(Refer Table: MDM Courses)**

Common guidelines to students:

1. The Multidisciplinary Minor (MDM) must be compulsorily chosen from engineering discipline different from the student's Major engineering programme. Students should take MDM from the list of MDM Offered by Other Departments/Branches/ programmes only. Ex: A Student of Mechanical Engineering should take MDM from other departments/branches/Programmes except MDM offered by Mechanical Engineering Dept. **(Refer Table: MDM Courses)**
2. The entry point for any compulsory MDM programme is the 3rd semester. The required credits for MDM courses must be acquired from the 3rd semester of second year to the final year of UG Programme.
3. A student is required to continue with the selected Minor programme consistently throughout all six semesters.
4. No changes to the selected Minor programme will be permitted under any circumstances.
5. A student may choose only one Minor programme (track), from the list of MDM courses offered by the institute.
6. The allotment of the MDM course will be based on the marks obtained by the student in the first year for Sem-I and Sem-II combinely.
7. The compulsory MDM programme will admit a maximum of 75 students into its minor course, with selection strictly based on first-year academic merit. Preference order for allocating MDM minor will follow the hierarchy: Candidates with no backlogs first, then those with one backlog, followed by those with two backlogs, and so on.

8. All students must complete the Google form provided by the Institute, indicating their preferences to MDM programme within the specified deadline. Students should ensure that they enter their accurate first year marks in the form along with the attachment of marksheets of Sem-I and Sem-II to avoid any discrepancies.

(Refer Table: MDM Courses)

List of S. Y. B. Tech. and T.Y.B.Tech MDM Courses Offered by the Various Programmes under the Faculty of Science and Technology at Shivaji University, Kolhapur

Sr. No.	Name of the Programme (Major) Offering MDM	Name of the corresponding Minor Programme to be offered	Semester	Name of the MDM Course offered by the Major Programme	Teaching scheme			Credits
					L	T	P	
01	Mechanical Engineering	1. Computer Science and Engineering 2. Electronics and Computer Science 3. Computer Science and Engineering (AIML) 4. Civil Engineering 5. Electronics and Telecommunication Engineering 6. Computer Science and Engineering (Data Science) 7. Electrical Engineering 8. Artificial Intelligence & Data Science 9. Electrical and Computer Engineering	III	MDM 01: Thermodynamics	2	-	-	2
			IV	MDM 02: Theory of Machines	2	-	-	2
			V	MDM 03:Heat Power Engineering	3	-	2	4
			VI	MDM 04: Machine Design	2	-	-	2
02	Computer Science and Engineering	1. Mechanical Engineering 2. Civil Engineering 3. Electronics and Telecommunication Engineering 4. Electrical Engineering 5. Mechanical and Mechatronics Engineering (Additive Manufacturing)	III	MDM 01: Data Structures using C	2	-	-	2
			IV	MDM 02: Object Oriented Programming	2	-	-	2
			V	MDM 03: Java Programming	3	-	2	4
			VI	MDM 04: Database Engineering	2	-	-	2

03	Electronics and Computer Science	1. Mechanical Engineering 2. Civil Engineering 3. Electrical Engineering 4. Mechanical and Mechatronics Engineering (Additive Manufacturing)	III	MDM 01: Logic Design	2	-	-	2
			IV	MDM 02: Electronics Measurements	2	-	-	2
			V	MDM 3 : Microprocessor and Microcontroller	3	-	2	4
			VI	MDM 4 : Introduction to IOT	2	-	-	2
04	Computer Science and Engineering (AIML)	1. Mechanical Engineering 2. Civil Engineering 3. Electronics and Telecommunication Engineering 4. Electrical Engineering 5. Mechanical and Mechatronics Engineering (Additive Manufacturing)	III	MDM 01: Object Oriented Programming	2	-	-	2
			IV	MDM 02: Introduction to AI	2	-	-	2
			V	MDM 03: Database Management	3	1	-	4
			VI	MDM 04: Internet of Things	2	-	-	2
05	Civil Engineering	1. Mechanical Engineering 2. Computer Science and Engineering 3. Electronics and Computer Science 4. Computer Science and Engineering (AIML) 5. Electronics and Telecommunication Engineering 6. Computer Science and Engineering (Data Science) 7. Electrical Engineering 8. Artificial Intelligence & Data Science 9. Electrical and Computer Engineering 10. Mechanical and Mechatronics Engineering (Additive Manufacturing)	III	MDM 01: Building Construction	2	-	-	2
			IV	MDM 02: Waste Management	2	-	-	2
			V	MDM 3 : Infrastructure Engineering	3	-	2	4
			VI	MDM 4: Concrete Technology	2	-	-	2

06	Electronics and Telecommunication Engineering	1. Mechanical Engineering 2. Computer Science and Engineering 3. Computer Science and Engineering (AIML) 4. Civil Engineering 5. Computer Science and Engineering (Data Science) 6. Electrical Engineering 7. Artificial Intelligence & Data Science 8. Electrical and Computer Engineering 9. Mechanical and Mechatronics Engineering (Additive Manufacturing)	III	MDM 01: Electronics System	2	-	-	2
			IV	MDM 02: Electronics Measurements	2	-	-	2
			V	MDM-3: Communication Engineering	3	-	2	4
			VI	MDM-4:Mobile Technology	2	-	-	2
07	Computer Science and Engineering (Data Science)	1. Mechanical Engineering 2. Civil Engineering 3. Electronics and Telecommunication Engineering 4. Electrical Engineering 5. Mechanical and Mechatronics Engineering (Additive Manufacturing)	III	MDM 01: C Programming	2	-	-	2
			IV	MDM 02: Python Programming	2	-	-	2
			V	MDM 03:Programming using Java	3	-	2	4
			VI	MDM 4:Database concepts and Design	2	-	-	2
08	Electrical Engineering	1. Mechanical Engineering 2. Computer Science and Engineering 3. Electronics and Computer Science 4. Computer Science and Engineering (AIML) 5. Civil Engineering 6. Electronics and Telecommunication Engineering 7. Computer Science and Engineering (Data Science) 8. Artificial Intelligence & Data Science 9. Mechanical and Mechatronics Engineering (Additive Manufacturing)	III	MDM 01: Introduction to Electrical and Electronics Circuits	2	-	-	2
			IV	MDM 02: Electrical Power System	2	-	-	2
			V	MDM 03:Electrical Machines	3	-	2	4
			VI	MDM 04:Power Electronics and Embedded System	2	-	-	2

09	Artificial Intelligence & Data Science	1. Mechanical Engineering 2. Civil Engineering 3. Electronics and Telecommunication Engineering 4. Electrical Engineering 5. Mechanical and Mechatronics Engineering (Additive Manufacturing)	III	MDM 01: Fundamentals of AI	2	-	-	2
			IV	MDM 02: Python for Data Science	2	-	-	2
			V	MDM 03: Machine Learning	3	-	2	4
			VI	MDM 04: Deep Learning	2	-	-	2
10	Electrical and Computer Engineering	1. Mechanical Engineering 2. Civil Engineering 3. Electronics and Telecommunication Engineering 4. Mechanical and Mechatronics Engineering (Additive Manufacturing)	III	MDM 01: Renewable Energy Sources	2	-	-	2
			IV	MDM 02: Python Programming	2	-	-	2
			V	MDM 03: Operating System	3	-	2	4
			VI	MDM 04: Electrical Design Estimation And Costing	2	-	-	2
11	Mechanical and Mechatronics Engineering (Additive Manufacturing)	1. Computer Science and Engineering 2. Electronics and Computer Science 3. Computer Science and Engineering (AIML) 4. Civil Engineering 5. Electronics and Telecommunication Engineering 6. Computer Science and Engineering (Data Science) 7. Electrical Engineering 8. Artificial Intelligence & Data Science 9. Electrical and Computer Engineering	III	MDM 01: Computer Aided Design (CAD)	2	-	-	2
			IV	MDM 02: Product Design & Development	2	-	-	2
			V	MDM 03: Fundamentals of Design for Product Manufacturing (FDPM)	3	-	2	4
			VI	MDM 04:Ergonomics & Human Factors	2	-	-	2

Third Year Exit: Teaching Methodology, Assessment and Evaluation

[I] As per R. R. B. Tech. 12.3 Rule: Award of Degree

If a student passes all the courses of first year, second year and third year and earns the requisite number of credits, the student will become entitled to three years Bachelor's Degree in Vocational in the faculty of his/her major subject. If he/she wants to exit, can exit the programme with three years Bachelor's Degree in Vocational. However, for the award of three years Bachelor's Degree in Vocational in the faculty of his/her major subject with 132 credits, an additional 8 credits from Exit Courses are required to earn.

[II] Third Year Exit Course:

Methodology 1:

1. The students should complete two online certification courses (NPTEL) related to their programme, each of 3 credits. In addition to this, they will also need to complete 2 credits worth of two Virtual Lab work related to online certification courses. These additional 8 credits earn by students shall be based upon skill based vocational courses or internship/Apprenticeship.
2. The NPTEL courses are likely to be available online and can be completed at the student's own pace. The content will be specific to the student's field of study or programme. The skill based vocational courses shall be analogous to the Baskets/Areas provided by the concerned BoS.

3. The student must complete two virtual lab work that adds 2 credits to simulate practical or experimental learning experiences in a controlled virtual environment.
4. **Examination scheme:** The marks gained from the two NPTEL Courses (3 credits each) are converted to a total of 100 marks. The report for the two Virtual Lab work of 2 credits will be evaluated for 25 marks. The report should include a detailed write-up and analysis of the virtual lab experiments conducted, encompassing the methodology, results, and conclusions.
5. There may be uncertainty in availability of the NPTEL courses offered by concerned BoS as there is continuous updatation of the NPTEL courses. The students can choose equivalent NPTEL course of the required duration with prior permission from the concerned institute. The concerned institute should communicate to Concerned BoS for their permission. For NPTEL course registration, the students are required to visit to website https://swayam.gov.in and create their account. Log in the account and join the required course and follow the instructions to compete the course. Similarly, for Virual Lab, the students are required to visit to website https://www.vlab.co.in and create their account. Log in the account and join the required lab and follow the instructions to compete the course (need to perform all listed experiments under that Lab). To fulfill the requirement of 06 credits, students can go for two courses each of 12 weeks.

Methodology 2:

1. The students should complete two online certification courses (NPTEL) related to their programme, each carrying 2 credits. In addition to this, they will also need to complete 4 credits worth of two physical internship/Apprenticeship (each of 40 hrs) work from relevant industry. These additional 8 credits earned by the students shall be based upon skill based vocational courses or internship/Apprenticeship.
2. The NPTEL courses are likely to be available online and can be completed at the student's own pace. The content will be specific to the student's field of study/programme. The skill-based vocational courses shall be analogous with the list provided by the concerned BoS.
3. The student should complete two physical internship/Apprenticeship (each of 40 hrs) work from relevant industrial practices that adds 4 credits to simulate practical or experimental learning experiences in a controlled virtual environment.
4. **Examination scheme:** The marks gained from the two NPTEL Courses (2 credits each) are converted to a total of 100 marks. The report for the performed two physical internship/Apprenticeship (each of 40 hrs) work from relevant industrial practices of 4 credits will be evaluated for 25 marks. The report should include a detailed write-up and analysis of two physical internship/Apprenticeship (each of 40 hrs) work along with certificate of internship/Apprenticeship from

relevant industrial practices conducted, encompassing the methodology, results, and conclusions.

5. There may be uncertainty in availability of the NPTEL courses offered by concerned BoS as there is continuous updatation of the NPTEL courses. The students can choose equivalent NPTEL course of the required duration with prior permission from the concerned institute. The concerned institute should communicate to Concerned BoS for their permission. For NPTEL course registration, the students are required to visit to website https://swayam.gov.in and create their account. Log in the account and join the required course and follow the instructions to compete the course.

SY B.Tech Exit Course

Exit option : Award of UG Diploma in Major with 88 credits and an additional 8 credits from following Exit Courses				
Sr. No	**Course Code**	**NPTEL Course Title**	**Mode**	**Credit s**
1	NPTEL	Electricity and Electrical Wiring	Online/ offline certification Course or project of total 8 credits	3
2	NPTEL	Artificial Intelligence		3
Virtual Lab				
1	Virtual Lab	Electrical Machines Lab		1
2	Virtual Lab	Computer Organization Lab		1

Design Thinking Course: Teaching Methodology, Assessment, and Evaluation

- The Non Credit Course under Design Thinking Category is offered to the students in Fifth or Sixth Semester through Massive Open Online Courses (MOOCs), and students may select a course from the following list or relevant course available on the respective online platform at that time. The course should have duration of not less than 4 weeks and not more than 6 weeks with minimum of 20 lectures and maximum of 30 lectures.
- The course is learned in online mode and can be completed by the student at their own pace within the prescribed duration.
- For enrollment, students are required to visit the SWAYAM or Coursera platform, register, and create their individual accounts.
- After successful registration, students must log in to their accounts, enroll in the course, and follow all instructions provided to complete the course.
- A Departmental Course Coordinator shall be appointed for the respective course.
- Students must submit all weekly assignments available on the respective platform, or those assigned by the Course Coordinator with prior approval from the respective Course Coordinator for assessment and evaluation.
- The Institute shall issue a Course Completion Certificate to students only after fulfilment of the following requirement:

    - Successful Completion and submission of 100% of the weekly assignments.

- Students are expected to adhere to all course guidelines and complete the course within the stipulated timeframe specified on the respective platform or by the Course Coordinator.

Online Platform- Swayam

1] Course Title- Design Thinking

Instructor-
Dr. Rajeshwari Patil, Dr. Manisha Shukla, Dr. Deepali Raheja, Dr. Mansi Kapoor

Sri Balaji University Pune

Course Information

Welcome to the captivating world of Design Thinking! This online course is designed to introduce you to the essential principles and techniques of Design Thinking—a powerful approach to problem-solving and innovation that has gained widespread recognition across various sectors in today's contemporary era.

In this course, you will discover that Design Thinking is much more than mere thinking. It is a mindset—an innovative and human-centric approach to identifying problems, designing effective solutions, and delivering outcomes that address unmet human needs.

Are you ready to unlock your creative potential and become a visionary leader in the business world? Join us on an exhilarating journey as we dive deep into the transformative power of design thinking through our immersive MOOC course on "Design Thinking."

Prepare to embark on a dynamic adventure where you will explore cutting-edge methodologies, challenge conventional thinking, and develop the essential skills to drive innovation. By participating in this course, you will be equipped with actionable strategies to tackle complex problems, discover untapped opportunities, and create value in today's ever-evolving business landscape.

Get ready to unleash your imagination, collaborate with like-minded individuals, and revolutionize your approach to problem-solving. Enroll now and embrace the boundless possibilities that await you!

This course adopts the Learner-Centric Model approach developed by IIT Bombay while planning, designing, and conducting this MOOC.

Learning Objectives-

This course will help you gain a strong foundation in design thinking principles and equip you with the necessary skills to apply this methodology in your future endeavors. Also, this course will help you to develop a problem-solving mindset and the ability to approach challenges from a human-centered perspective.

Course outline-

Week 0: Welcome to the course
Week 1: Foundation of Design Thinking
Week 2: Empathy-Foundation and Tools of Empathy
Week 3: Define-Foundation and Tools
Week 4: Ideate-Foundation and Tools
Week 5: Prototype & Foundation and Tools
Week 6: Learn From Practitioner

Syllabus-

Week/ Module	Topics
Week 0	• Demo Video • Welcome to the course • Course Schedule ● Grading Policy ● Exam Details ● FAQ
Week 1	**Foundation of Design Thinking** • Introduction to Design Thinking • Significance of Design Thinking • Key Tenets of Design Thinking • Design Thinking Process- 4 Critical Questions • Design Thinking Process • Wicked Problems • How Design Thinking is Different from Traditional Thinking • The Knowledge Funnel • Cognitive Bias: What Design Thinkers Should Avoid •
Week 2	**Empathy-Foundation and Tools of Empathy** • Foundation of Empathy • Purpose of empathy • Observation as a tool of empathy • Methods of Observation • Empathetic Interview • Stakeholder maps • Jobs to be done • Empathy Maps
Week 3	**Define- Foundation and tools** • Rules of Defining • Importance of Defining • Customer Journey Map • Customer experience • Persona
Week 4	**Ideate-Foundation and Tools** • Introduction to Ideation • Double Diamond • Brainstorming • Rules for Brainstorming • Mind Mapping • Worst Possible Idea

Week 5	**Prototype -Foundation and Tools** • Concept of Prototyping • Paper prototype • Story Board prototype • Scenario prototype • Low fidelity and high fidelity Test Foundation and Tools • Introduction to Test
Week 6	**Learn from Practitioner** • Interview 1 Mr Rohit Dubepatil - Director ORAH Nutrichem.Pvt.Ltd • Interview 2 Dr Bala Ramadurai • Interview 3Mr Abhijeet Kumar- Founder StepBeta • Interview 4 Ms Savita Rajiv

Online Platform- Coursera

Course Title- Design Thinking and Innovation

Instructor:

B K Chakravarthy –
IIT Bombay

Syllabus-

Module 1-Innovation by Design:
Introducing the fundamental concepts of design thinking and the 7 Concerns for Innovation. This module will establish the foundation for understanding how design can solve complex problems by focusing on user needs and iterative innovation. Understand the principles of design thinking. Familiarize yourself with the 7 Concerns for Innovation. Recognize the importance of collaboration in the innovation process.

Module 2- The resolve to solve a problem:
Every design project is initiated by a _need', which becomes _The Cause' of the entire journey that follows. This need may be a commercial requirement, a social necessity or a specific niggling problem with an existing product. The recognition of such a need is a key trigger for the project and it can be identified by any of the stakeholders connected to the product – a product manufacturer or marketer, a user or a product designer.

Module 3- Understanding the problem space:
To study and understand an existing product or similar products in the market, it is critical that the environment in which the product is used, which designers like to call 'The Context' is understood comprehensively. This means that a designer must study the users and their perspectives on the product. Often, this involves several rounds of interaction and observation.

Module 4- Arriving at a Design insight:
At this stage, the designer analyses all the information gathered and methodically lists out their observations and perceptions of any notable issues in the use of the product. Such analysis results in the thorough, all-round 'Comprehension' of the product as it functions within the context of its use. The design insights thus arrived at give rise to creative ideas, and form the basis of the intervention that follows.

Module 5- Creating a product brief:
The Check' is an essential step in understanding what requirements the product should ultimately meet and what problems the design intervention should address. The check, which is often a document in the form of a product brief, is created from the design insights and must be approved by the client. The product brief is an important point of reference throughout the journey as concepts and prototypes are created and evaluated.

Module 6- Generating ideas and concepts:
At this stage called 'The Conception' , designer arrives at multiple ideas to come up with solutions for the problems listed using the product brief. At this crucial stage, ideas are proposed and grouped into clusters. This makes possible the consideration of multiple concepts. Finally, the team zeros in on one all-encompassing concept that best addresses all aspects of the product.

Module 7- Building Mockups and prototypes:
The final concept is further refined with reference to criteria like materials available or desirable, and the conditions in which the product is to be manufactured. At this penultimate stage, the designer creates several style options according to the user profile and selects one that best addresses all the aesthetic concerns. The chosen product design is showcased by 'Crafting' small-scale mock-up models, CAD models, or working prototypes. A final version of the product that meets all conditions in the product brief is then taken up for mass production.

Module 8- Delighting the user:

The last but critically important concern is 'The Connection' the new product makes with the user. This connection or the bond between the user and the product is formed only when the user is satisfied with the product‘s performance and begins to cherish it, which in turn creates an increasing demand for the product. In fact, it is the customer‘s satisfaction that makes a winning project and functions as the most important criterion for innovation.

SCHEME OF INSTRUCTION & SYLLABI

Programme Electrical and Computer Engineering

Scheme of Instructions: Third Year B. Tech. Electrical and Computer Engineering

Semester – V

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME			
									MSE	ISE/CA	ESE	TOTAL
1	PCC		Power Electronics	3	--	--	3	3	30	10	60	100
2	PCC		Microcontroller	3	--	--	3	3	30	10	60	100
3	PCC		Transmission and Distribution	3	--	--	3	3	30	10	60	100
4	PEC		PEC I	3	--	--	3	3	30	10	60	100
5	MDM		Multi-disciplinary Minor – 03	3	--	--	3	3	30	10	60	100
6	OE		Open Elective -03	2	--	--	2	2	30	10	60	100
7	PCC		Power Electronics Lab	--	--	2	2	1	-	25	25	50
8	PCC		Microcontroller Lab	--	--	2	2	1	-	25	25	50
9	PEC		PEC I Lab	--	--	2	2	1	-	25	--	25
10	MDM		Multi-disciplinary Minor– 03 Lab	--	--	2	2	1	-	50	--	50
11	EL		Minor Project 01	--	--	2	2	1	-	25	--	25
			Total	**17**	**--**	**10**	**27**	**22**	**180**	**210**	**410**	**800**

L- Lecture T-Tutorial P-Practical MSE- Mid Semester Examination ISE/CA- In Semester Evaluation/Continuous Assessment
ESE- End Semester Examination (For Laboratory End Semester performance)

Course Category	Basic Science Courses (BSC)	Engineering Science Courses (ESC)	Programme Core Course (PCC)	Programme Elective Course (PEC)	Open Elective other than particular program (OE/MDM)	Vocational and Skill Enhancement Course (VSEC)	Humanities Social Science and Management (HSSM)	Experiential Learning (EL)	Co-curricular And Extracurricular Activities (CCA)
Last Sem. Cumulative Sum	**16**	**18**	**25**	**-**	**10**	**05**	**12**	**--**	**02**
Semester Credits	**-**	**-**	**11**	**04**	**06**	**-**	**-**	**01**	**-**
Cumulative Sum	**16**	**18**	**36**	**04**	**16**	**05**	**12**	**01**	**02**

PROGRESSIVETOTALCREDITS:88+22=110

SCHEME OF INSTRUCTION & SYLLABI

Programme Electrical and Computer Engineering

Scheme of Instructions: Third Year B. Tech. Electrical and Computer Engineering

Semester – VI

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME			
									MSE	ISE/CA	ESE	TOTAL
1	PCC		Signal and Systems	3	--	--	3	3	30	10	60	100
2	PCC		Control System	3	1	--	4	4	30	10	60	100
3	PCC		Computer Algorithm	3	--	--	3	3	30	10	60	100
4	PEC		PEC II	3	--	--	3	3	30	10	60	100
5	PEC		PEC III	3	--	--	3	3	30	10	60	100
6	MDM		Multi-disciplinary Minor – 04	2	--	--	2	2	30	10	60	100
7	PCC		Control System Lab	--	--	2	2	1	-	50	25	75
8	PCC		Computer Algorithm Lab	--	--	2	2	1	-	50	25	75
9	EL		Mini Project 02	--	--	4	4	2	-	50	--	50
			Total	**17**	**1**	**8**	**26**	**22**	**180**	**210**	**410**	**800**

L- Lecture T-Tutorial P-Practical MSE- Mid Semester Examination ISE/CA- In Semester Evaluation/Continuous Assessment
ESE- End Semester Examination (For Laboratory End Semester performance)

Course Category	Basic Science Courses (BSC)	Engineering Science Courses (ESC)	Programme Core Course (PCC)	Programme Elective Course (PEC)	Open Elective other than particular (OE/MDM)	Vocational and Skill Enhancement Course (VSEC)	Humanities Social Science and Management (HSSM)	Experiential Learning (EL)	Co-curricular And Extracurricular Activities (CCA)
Last Sem. Cumulative Sum	**16**	**18**	**36**	**04**	**16**	**05**	**12**	**01**	**02**
Semester Credits	**-**	**-**	**12**	**06**	**02**	**--**	**-**	**02**	**-**
Cumulative Sum	**16**	**18**	**48**	**10**	**18**	**05**	**12**	**03**	**02**

PROGRESSIVE TOTALCREDITS:110+22=132

Shivaji University, Kolhapur

Third Year B. Tech. Electrical and Computer Engineering

Semester –V

Course Title		**Power Electronics**		**Course Category**		**PCC**	
Contact Hrs /Week		3		**Course Code**			
Teaching Scheme				**EXAM SCHEME**			
L	**T**	**P**	**Course Credits**	**MSE**	**ISE/CA**	**ESE**	**TOTAL**
3	**---**	**--**	**3**	**30**	**10**	**60**	**100**

Course Objectives:

1) To give an overview of applications power electronics, different types of power semiconductor devices, their switching characteristics, power diode characteristics, types, their operation.
2) To explain the techniques for design and analysis of single phase and three phase diode rectifier circuits.
3) To explain different power transistors, their steady state and switching characteristics and limitations.
4) To explain different types of Thyristors, their gate characteristics and gate control requirements.
5) To explain the design, analysis techniques, performance parameters and characteristics of controlled rectifiers, DC- DC, DC -AC converters and Voltage controllers.

Unit No	**Contents**	**Hrs**
Unit-1	**Introduction:** Applications of Power Electronics, Ideal Characteristics of switches Characteristics of practical devices. control characteristics of power devices, Types of Power Electronic Circuits. **Power Diodes:** Introduction, Diode Characteristics, Reverse Recovery Characteristics, Power Diode Types, Silicon Carbide Diodes, Schottky Diodes, Freewheeling diodes.	**7 Hrs**
Unit-2	**Single phase and three phase Rectifiers:** Single phase half wave and single-phase full wave diode bridge. Three phase half wave and three phase full wave diode bridge with R and RL load. Transformer power rating for above configurations waveforms of source current , DC current and output DC voltage waveforms .	**7 Hrs**
Unit-3	**Power Transistors:** Introduction, Bipolar Junction Transistors-Steady State Characteristics, Switching Characteristics, Switching Limits, Power MOSFETs -Steady State Characteristics, Switching Characteristics, IGBTs; BJT Base Drive, MOSFET Gate Drive, Isolation of Gate and Base Drives.	**7 Hrs**
Unit-4	**Thyristors:** Introduction, Thyristor Characteristics, Two-Transistor Model of Thyristor, Thyristor Turn- On, Thyristor Turn-Off, A brief study on Thyristor Types, Series Operation of Thyristors, Parallel Operation of Thyristors, di/dt Protection, dv/dt Protection	**7 Hrs**
Unit-5	**Controlled Rectifiers:** Introduction, Single phase half wave circuit with RL Load, Single phase half wave circuit with RL Load and Freewheeling Diode,	**7 Hrs**

	Single phase half wave circuit with RLE Load, Single-Phase Full Converters with RLE Load, Single-Phase Dual Converters, Principle of operation of Three- Phase duel Converters.	
Unit-6	**DC-DC Converters:** Introduction, principle of step-down chopper with R and RL load; principle of step-up chopper with R load, Control strategies, performance parameters, DC-DC converter classification. **DC-AC Converters:** Introduction, principle of operation single phase bridge inverters, voltage control of single-phase inverters, Harmonic reductions, Current source inverters.	**8 Hrs**

Course Outcomes:

1. To understand the concept of different types of power semiconductor devices, their switching characteristics, power diode characteristics, types, their operation.
2. To understand the concept of design and analysis of single phase and three phase diode rectifier circuit.
3. To understand the different power transistors, their steady state and switching characteristics and limitations.
4. To understand the different types of Thyristors, their gate characteristics and gate control requirements.
5. To understand the concept of design, analysis techniques, performance parameters and characteristics of controlled rectifiers.
6. To understand the concept of design, analysis techniques, performance parameters and characteristics of DC- DC, DC -AC converters and Voltage controllers.

Books:

1. Power Electronics: Circuits Devices and Applications Mohammad H Rashid, Pearson 4th Edition, 2014.
2. Power Electronics P.S. Bimbhra Khanna Publishers 5th Edition, 2012.
3. Power Electronics Daniel W Hart McGraw Hill 1st Edition, 2011.
4. Power Electronics: Converters, Applications and Design Ned Mohan et al Wiley 3rd Edition, 2014.

Shivaji University, Kolhapur

Third Year B. Tech. Electrical and Computer Engineering

Semester – V

Course Title	Microcontroller			Course Category		PCC	
Contact Hrs/Week	3			Course Code		ECE0	
Teaching Scheme				EXAM SCHEME			
L	T	P	Course Credits	MSE	ISE/CA	ESE	TOTAL
3	-	-	3	30	10	60	100

Course Objectives:

- Understand the difference between a Microprocessor and a Microcontroller and embedded microcontrollers.
- Study the 8051 instructions and develop programs for control applications using assembly language
- Interface 8051 to I/O devices using it's I/O ports.
- Understand the operation and use of inbuilt Timers/Counters and Serial port of 8051.
- Understand the basics of Embeded system and programs related to arithmetic ,logical operations.

Unit No and Title	Contents	Hrs
Unit-1	**8051 Microcontroller**: Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture-Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.	**6 Hrs**
Unit-2	**8051 Instruction Set**: Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples (without loops) to use these instructions.	**7 Hrs**
Unit-3	**I/O Port Interfacing & Programming:** I/O Programming in 8051 C, LCD interfacing, DAC 0808 Interfacing, ADC 0804 interfacing, Stepper motor interfacing and DC motor control.	**6 Hrs**
Unit-4	**8051 Timers and Serial Port**: 8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode2 on a port pin. 8051 Serial Communication- Basics of Serial Data Communication, RS232 standard, 9 pin RS232 signals.	**5 Hrs**

Unit-5	**Interrupt Programming:** Basics of Interrupts, 8051 Interrupts, Programming Timer Interrupts, Programming Serial Communication Interrupts, Interrupt Priority in 8051.	**6 Hrs**
Unit-6	**Embedded C: -** Introduction to embedded C and its applicability to 8051, its pros and cons, general structure of embedded C program, data types, memory types and models, pointers, pointer's memory type, typed and untyped pointers. arithmetic and logical operators, example programs.	**6 Hrs**

Course Outcomes:

At the end of the course the student will be able to:

1. Explain the difference between Microprocessors & Microcontrollers, Architecture of 8051 Microcontroller.
2. Write 8051 Assembly level programs using 8051 instructions set.
3. Develop programs to interface I/O devices with 8051 Microcontroller
4. Explain the programming operation of Timers/Counters and Serial port of 8051 Microcontroller
5. Illustrate the Interrupt Structure of 8051 Microcontroller & its programming.
6. Describe the structure of the Embedded system.

Text Books:

1. "The 8051 Microcontroller and Embedded Systems – using assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
2. "The 8051 Microcontroller", Kenneth J. Ayala, 3rd Edition, Thomson/Cengage Learning.

Reference Books:

1. "The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005.
3. Embedded C - Michael .J.Pont - Pearson Education -2002 ISBN 0 201 79523 X

Shivaji University, Kolhapur

Third Year B. Tech. Electrical and Computer Engineering

Semester – V

Course Title	**Transmission and Distribution**	**Course Category**	**PCC**
Contact Hrs/Week	**3**	**Course Code**	**ECE0**

Teaching Scheme				**EXAM SCHEME**			
L	**T**	**P**	**Course Credits**	**MSE**	**ISE/CA**	**ESE**	**TOTAL**
3	**-**	**-**	**3**	**30**	**10**	**60**	**100**

Course Objectives:

1. To study the constructional features of Transmission System for specific Application.
2. To study the Classification of Transmission System
3. To study different Equipment of transmission system
4. To study the analyse Transmission Line Performance
5. To perform mechanical design of overhead lines.
6. Analyses protective devices such as fuses, circuit breakers, relays, and automatic reclosers, as covered on the

Unit No and Title	**Contents**	**Hrs**
Unit-1	**Structure Of Power System :** Structure Of Power System Component of power system , Current transformers (CT), Potential transformers (PT) , Circuit breaker (CB), Isolators or Isolating switches **Parameters Of Single And Three Phase Transmission Lines With Single And Double Circuits** : Constants of a Transmission Line, (i)Resistance, (ii) Inductance, iii)Capacitance, Symmetrical Spacing, Unsymmetrical Spacing.	**7 Hrs**
Unit-2	**Concept Of Self - GMD And Mutual - GMD:** (i)Self-GMD (Ds), (ii)Mutual-GMD, Skin Effect, Proximity Effect , Basic EHVAC And HVDC Transmission System. Merits & Demerits Of HVDC **Classification Of Overhead Transmission Lines:** Short transmission lines, Medium transmission lines, Long transmission lines. Voltage Regulation, Transmission efficiency. Effect of Load P.F. On Regulation and Efficiency, Power Circle Diagram, Corona Factors Affecting , Advantages and Disadvantages of Corona SAG In Overhead Lines	**6 Hrs**
Unit-3	**Equipment of Transmission & System:** Type Of Tower, Line Supports, Wooden poles, RCC poles, Steel towers, Types Of Insulator, Potential Distribution Over Suspension Insulator String, String Efficiency **Classification Based Upon Number Of Conductors In The Cable**: Testing Of Insulator, Types of Testing Of Insulators, Construction Of Cables, Types Of Underground Cables, Classification Based Upon Construction of The Cable . Construction Of Cables .	**7 Hrs**

Unit-4	**Distribution Systems:** General Aspects, a typical distribution system , Kelvin's Law, Limitations of Kelvin's law, AC Distribution- Primary AC Distribution System, Secondary AC Distribution System, - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems Types D.C. Distribution,	**7 Hrs**
Unit-5	**Sub-transmission:** basic information of Overhead and Underground System , Substation Bus Schemes, Breakers And A Half With Two Main Buses, **analyses Transmission Line Performance Types Of Feeders** Additional factors affecting primary-feeder voltage-level selection decision, Factors Affecting Feeder Routing Decision, Detailed Description Of Distribution Transformer Loading	**6 Hrs**
Unit-6	**Protection and Coordination** : Protection requirements Types of faults, Devices Fuses, circuit reclosers, circuit breakers, sectionalizes, Protective device coordination,. Advantage and limitation , application of protection and coordination	**6 Hrs**

Course Outcomes: At the end of the course, the student will be able to:

1. Understand the construction and operation, Transmission Lines .
2. Understand the construction and operation, classification and types of Transmission Lines.
3. Describe the performance Transmission Lines e characteristics and Transmission Lines application.
4. Understand the structure of power transmission and distribution systems, including generation, substations, and components.
5. Analyse the efficiency and voltage regulation of short, medium, and long transmission lines.
6. Understand the selection and operation of insulators, insulators string efficiency, and the effects of corona.
7. Understand the selection and operation of insulators, insulators string efficiency, and the effects of corona.

Books: Text Books

1. Electric Power Generation, Transmission and Distribution by S.N. Singh
2. Principles of Power System V. K. Mehta & Rohit. Mehta
3. Transmission & Distribution Of Electrical Power by J.B. Gupta (S.K. Kataria & Son
4. S.N. Singh - Electric Power Generation, Transmission and Distribution:

. **Reference Books**

5. Principles of Power System V. K. Mehta & Rohit. Mehta
6. Power System Analysis and Design – B. R. Gupta
7. Electric Power Transmission and Distribution – S. Sivanagaraju & S. Satyanarayana

Shivaji University, Kolhapur

Third Year B. Tech. Electrical and Computer Engineering

Semester – V

Course Title	**Electrical power Generation and Utilisation**	**Course Category**	**PEC-1**
Contact Hrs/Week	**3**	**Course Code**	**ECE0**

Teaching Scheme				**EXAM SCHEME**			
L	**T**	**P**	**Course Credits**	**MSE**	**ISE/CA**	**ESE**	**TOTAL**
3	**-**	**-**	**3**	**30**	**10**	**60**	**100**

Course Objectives:

1. To understand the concept Electrical Energy Generation using Conventional Energy Sources
2. To analyze Solar Energy application
3. To study about Electric traction

Unit No and Title	**Contents**	**Hrs**
Unit-1	**Electrical Energy Generation using Conventional Energy Sources:** Electric energy demand, Electric energy growth in India, Power crisis in India. **Types of Generation:** Diesel &Gas Power Plant : Advantages, Disadvantages, applications of Diesel plant. Gas Turbine plant: Principle of operation, Open cycle, closed cycle plant & Applications of gas plant. Thermal power plant: Main & auxiliary equipment's in Thermal plant.	**7 Hrs**
Unit-2	**Solar Energy**: Introduction, Beam & Diffuse solar radiation, Derived solar angles, sunrise sunset & day length, sunrise hour angle **Solar Photovoltaic:** Introduction Solar cell characteristics & losses. Emerging solar technologies, Solar PV modules, Design of PV module, Sizing of Battery, inverter & charge controller. IV curve for PV module	**6 Hrs**
Unit-3	**Wind Energy:** Introduction, Principle of wind energy conversion, power duration & velocity duration characteristics of wind, advantages & disadvantages, Classification of wind mills, basic components of wind, Wind Data &site selection considerations, Social economic & environmental considerations.	**7 Hrs**
Unit-4	**Electric Heating and Welding :** Classification of electric heating, heating methods, Resistance heating, design of heating element, Arc furnaces, induction heating, Induction furnaces, Dielectric heating, Electric arc welding, welding transformer, Power supply and control of electric welding, Laser beam welding.	**7 Hrs**

Unit-5	**Electric traction :** DC, AC and composite traction systems, main line and suburban systems, Comparison with Diesel-Electric traction, traction equipment's, Trolley. negative booster, overhead lines, current collectors, traction substations .	**6 Hrs**
Unit-6	**Mechanics of train movement :** Trapezoidal and quadrilateral speed-time Vacuum brake and Air brake systems, regenerative braking, calculation of energy returned during regenerative braking. curves, Maximum, average and scheduled speeds , Specific Energy Output.	**6 Hrs**

Course Outcomes: At the end of the course, the student will be able to:

1. Explain about Electrical Utilization application
2. Explain the Non-Conventional energy
3. Explain about Electric traction. Use.

Books: Text Books

1. Generation of Electrical energy by Dr. B.R. Gupta. S. Chand Publications.
2. Utilization of Electric Power and Electric Traction: J.B. Gupta, 8th Edition.

Reference Books

1. Utilization of Electric Energy: Openshaw Taylor
2. Non Conventional& Renewable energy sources by S.S. Thipse Narosa publishing house

Shivaji University, Kolhapur

Third Year B. Tech. Electrical and Computer Engineering

Semester – V

Course Title	**Operating System**	**Course Category**	**MDM 03**
Contact Hrs/Week	**3**	**Course Code**	**ECE0**

Teaching Scheme				**EXAM SCHEME**			
L	**T**	**P**	**Course Credits**	**MSE**	**ISE/CA**	**ESE**	**TOTAL**
3	**-**	**-**	**3**	**30**	**10**	**60**	**100**

Course Objectives:

1. To explain main components of OS and their working
2. To familiarize the operations performed by OS as a resource Manager.
3. To impart various scheduling policies of OS.
4. To teach the different memory management techniques.

Unit No and Title	**Contents**	**Hrs**
Unit-1	**Operating System services and components:** Operating System: concept, functions, Different types of Operating System: Batch Operating System, Multi-programmed, Time-Shared Operating System, Multiprocessor System, Distributed System, Real Time System, Mobile OS (Android OS)	**5 Hrs**
Unit-2	**Operating System components:** Command line-based Operating System: DOS, UNIX GUI based Operating System: WINDOWS, LINUX, MaC OS, Different Services of Operating System, System Calls: Concept, types of system calls, Operating System Components: Process Management, Main Memory Management, File Management, IO Management, Secondary Storage Management	**5 Hrs**
Unit-3	**Process Management:** Processes: process state, process control block, Process Scheduling: scheduling queues, types of schedulers, context switch, Inter Process Communication: Shared memory system, Message passing system, Threads: Benefits, User and Kernel level threads, Multithreading Models: One to One, Many to One, Many to Many, Execute process commands like: top, ps, kill, wait, sleep, exit, nice	**7 Hrs**
Unit-4	**CPU Scheduling:** Scheduling: Basic concept, CPU and I/O burst cycle, Preemptive and Non-preemptive scheduling, Types of Scheduling algorithms: First Come First Serve (FCFS), Shortest Job First (SJF), Round Robin (RR), Priority Scheduling, Deadlock: System Models, Necessary conditions Leading to Deadlock, Deadlock Handling: Deadlock prevention, Deadlock avoidance- Banker's Algorithm	**7 Hrs**
Unit-5	**Memory Management:** Basic Memory Management: Partitioning - Fixed and Variable, Memory Management Techniques: Paging, Segmentation, Virtual Memory: Basics, Demand paging, Page Fault, Page Replacement Algorithm: First In First Out (FIFO), Least Recently Used (LRU), Optimal	**7 Hrs**

Unit-6	**File Management:** File Concepts: Attributes, Operations, File types and File system structure, Accessing Methods: Sequential, Direct, File Allocation Methods: Contiguous allocation, Linked allocation, Indexed allocation, Directory Structure: Single level, Two level, Tree structured Directory	**8 Hrs**

Course Outcomes:

Students will be able to achieve & demonstrate the following COs on completion of course based learning

1. Explain the services and components of an Operating System.
2. Describe the different aspects of Process Management in an Operating System.
3. Implement various CPU Scheduling algorithms and evaluate their effectiveness.
4. Analyze the Memory Management techniques used by an Operating System.
5. Apply techniques for effective File Management in an Operating System.

Books: Text Books

1. Operating System: A Concept-Based Approach-Dhananjay M. Dhamdhere, McGraw Hill Education 3rd edition, ISBN: 978-1259005589

Reference Books

1. Operating Systems: Internals and Design Principles, William Stallings, Pearson Education 9th Edition, ISBN: 978-9352866717
2. Linux The Complete Reference, Richard PetersenMcGraw Hill, 6th edition, ISBN: 978-0071492478
3. Linux command line and shell scripting, Richard Blum, Wiley India, ISBN: 978-1118983843
4. Operating System Concepts, Abraham Silberschatz and James Peterson, Wiley India, ISBN: 9781119454083

Shivaji University, Kolhapur Third Year B. Tech. Electrical and Computer Engineering Semester – V							
Course Title	**Power Electronics Lab**			**Course Category**		**PCC**	
Contact Hrs/Week	**2**			**Course Code**			
Teaching Scheme				**Exam Scheme**			
L	**T**	**P**	**Course Credits**	**MSE**	**ISE/CA**	**ESE**	**TOTAL**
--	**-**	**2**	**1**	**--**	**25**	**25**	**50**

Course Objectives:

1. Understand the operating principles and V–I characteristics of power semiconductor devices such as SCR, MOSFET, and IGBT.
2. Analyze the behavior and performance of controlled rectifiers (half-controlled and fully controlled bridge rectifiers).
3. Study AC power control techniques using AC voltage regulators and TRIAC-based circuits.
4. Explore switching techniques in DC-DC converters like Jones chopper and Morgan's chopper.
5. Understand inverter operation and waveform generation in single-phase inverters.
6. Develop practical skills in designing, testing, and analyzing power electronic circuits.
7. Interpret experimental waveforms and compare them with theoretical results.

S.No.	Experiments
1	Study of characteristics of SCR,
2	Study of characteristics of MOSFET
3	Study of characteristics of IGBT
4	Study of Half controlled Bridge rectifier
5	Study of Fully controlled Bridge rectifier
6	Study of AC voltage Regulator.
7	Study of Light dimmer using Diac/Triac
8	Study of Jones chopper and Morgan's chopper
9	Study of Single-phase Inverter

Course Outcomes:

At the end of the course, the student will be able to:

1. Understand and plot characteristics of SCR, MOSFET, and IGBT.
2. Analyze operation of half and fully controlled rectifiers.
3. Study AC voltage control using regulators and TRIAC circuits.
4. Understand working of chopper circuits (Jones and Morgan's).
5. Analyze operation of single-phase inverter.
6. Perform experiments and interpret results effectively.

Shivaji University, Kolhapur

Third Year B. Tech. Electrical and Computer Engineering

Semester – V

Course Title	**Microcontroller Lab**			**Course Category**		**PCC**	
Contact Hrs/Week	**2**			**Course Code**		**ECE0**	
Teaching Scheme				**EXAM SCHEME**			
L	**T**	**P**	**Course Credits**	**MSE**	**ISE/CA**	**ESE**	**TOTAL**
-	**-**	**2**	**1**	**--**	**25**	**25**	**50**

Course Objectives:

1. To provide hands-on experience with microcontroller architecture and interfacing.
2. To understand input/output port configuration and peripheral interfacing.
3. To design and implement simple embedded system applications.
4. To familiarize students with debugging techniques and development tools.

S.No.	**Experiments**
1	Write a program for addition of two 8- bit number whose sum is 8-bit.
2	Write a program for Arithmetic and Logical operations
3	Write a program for arranging series of number in ascending/ Descending order.
4	Write a program to find the largest/smallest number in an array of number
5	Write a program to count the number of ones and zeros in two consecutive memory locations
6	Stepper motor control using 8051 microcontroller
7	Traffic light controller
8	Seven segment display

Course Outcomes: At the end of the course, the student will be able to:

1. Apply different 8051 microcontroller instructions to develop assembly language code for illustrating data transfer and arithmetic operations using Keil tool.
2. Design and develop assembly language program for 8051 using different branch control instructions in Keil.
3. Develop code for interfacing different modules

Shivaji University, Kolhapur Third Year B. Tech. Electrical and Computer Engineering Semester – V							
Course Title		**Electrical Power Generation and Utilization Lab**		**Course Category**		**PEC-1**	
Contact Hrs/Week		**2**		**Course Code**		**ECE0359**	
Teaching Scheme				**Exam Scheme**			
L	**T**	**P**	**Course Credits**	**MSE**	**ISE/CA**	**ESE**	**TOTAL**
--	**-**	**2**	**1**	**--**	**25**	**--**	**25**

Course Objectives:

1. To understand the basic principle of the experiment.
2. To study the working and operation of the equipment used.
3. To perform the experiment according to the standard procedure.
4. To observe, record, and analyze the experimental data accurately.
5. To verify the theoretical concepts through practical implementation.
6. To develop practical skills in handling laboratory instruments and interpreting results.

Sr. No.	Experiments
1	To Study different parts of Thermal power plant with neat diagram
2	To Study different Solar Cell Characteristics.
3	To Study different parts of typical wind mill.
4	Demonstration of different electrical and safety equipment used for arc welding.
5	Identification of different components required for various heating furnaces.
6	Selection of suitable current range of Welding generator set and Welding transformer for various thickness of metal job.
7	Identification of different electrodes used in arc welding.
8	Visit to a traction loco shed and observe various types of system used in traction.

Course Outcomes: At the end of the course, the student will be able to:

1. Gained a clear understanding of the experimental principle and procedure.
2. Acquired practical knowledge of operating laboratory equipment safely and correctly.
3. Successfully performed the experiment and obtained the required observations.
4. Analyzed the recorded data and interpreted the experimental results accurately.
5. Verified the relevant theoretical concepts through practical experimentation.
6. Improved problem-solving, technical, and report-writing skills through hands-on laboratory work.

Books: Text Books

1. Generation of Electrical energy by Dr. B.R. Gupta. S. Chand Publications.

Reference Books

1. Utilization of Electric Energy: Openshaw Taylor
2. Non-Conventional& Renewable energy sources by S.S. Thipse Narosa publishing house

Online Resources:

1. www.electricaltechnology.org\
2. https://www.har-tech.com/en/electric-arc-welding/
3. www.railwaygazette.com

Shivaji University, Kolhapur

Third Year B. Tech. Electrical and Computer Engineering

Semester – V

Course Title	**Operating system Lab**	**Course Category**	**MDM 03**
Contact Hrs/Week	**2**	**Course Code**	**ECE0**

Teaching Scheme				**Exam Scheme**			
L	**T**	**P**	**Course Credits**	**MSE**	**ISE/CA**	**ESE**	**TOTAL**
--	**-**	**2**	**1**	**--**	**50**	**--**	**50**

Course Objectives:

1. Use basic UNIX commands.
2. Learn shell programming.
3. Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, Priority, and Multilevel Queuing.
4. Programs on UNIX System calls.
5. Be exposed to process creation and inter process communication.
6. Implement memory management schemes and page replacement schemes.

Sr.No.	**Experiments**
1	System call commands in Linux such as fork(), exec(), getpid, pipe, exit, open, close, stat, uname.
2	Process related commands in Linux - top, ps, kill, wait, sleep, nice, renice,bg,fg.
3	a. Commands for Sending Messages to Logged-in Users -who, cat, wall, write, mesg. b. List Processes Attached to a Shared Memory Segment: ipcs.
4	Write a C/Python program to calculate average waiting time and Turnaround Time of n processes with First Come First Serve (FCFS) CPU scheduling algorithm.
5	Write a C/Python program to calculate average waiting time and Turnaround Time of n processes with Shortest Job First (SJF) CPU scheduling algorithm.
6	Write a C/Python program to calculate average waiting time and Turnaround Time of n processes with Priority CPU scheduling algorithm.
7	Write a C/Python program to calculate average waiting time and Turnaround Time of n processes with Round Robin (RR) CPU scheduling algorithm.
8	Write a C/Python program to implement Banker's Algorithm.
9	Basic memory management commands - df, free, vmstat, /proc/meminfo, htop.
10	Write a C/Python program on First In First Out (FIFO) Page Replacement algorithm.
11	Write a C/Python program on Least Recently Used (LRU) Page Replacement algorithm.
12	Write a C/Python program on sequential file allocation method.

Course Outcomes: At the end of the course, the student will be able to:

1. Get aquanted with the UNIX based systems
2. Create processes and implement IPC
3. Compare the performance of various CPU Scheduling Algorithm
4. Implement deadlock avoidance, and Detection Algorithms
5. Analyze the performance of the various page replacement algorithm

Books: Text Books

1. Operating System: A Concept-Based Approach-Dhananjay M. Dhamdhere, McGraw Hill Education 3rd edition, ISBN: 978-1259005589

Reference Books

- Operating Systems: Internals and Design Principles, William Stallings, Pearson Education 9th Edition, ISBN: 978-9352866717
- Linux The Complete Reference, Richard PetersenMcGraw Hill, 6th edition, ISBN: 978-0071492478
- Linux command line and shell scripting, Richard Blum, Wiley India, ISBN: 978-1118983843
- Operating System Concepts, Abraham Silberschatz and James Peterson, Wiley India, ISBN: 9781119454083

Online Resources:

Shivaji University, Kolhapur

Third Year B. Tech. Electrical and Computer Engineering

Semester – V

Course Title	**Minor Project 01**			**Course Category**		**EL**	
Contact Hrs/Week	**2**			**Course Code**			
Teaching Scheme				**EXAM SCHEME**			
L	**T**	**P**	**Course Credits**	**MSE**	**ISE/CA**	**ESE**	**TOTAL**
--	**-**	**2**	**1**	**---**	**25**	**---**	**25**

Course Objectives:

1. Identify simple real-world engineering problems related to electrical and computer systems.
2. Apply basic concepts of electrical, electronics, and programming to develop solutions.
3. Design and implement small-scale hardware/software-based systems.
4. Gain hands-on experience with tools, components, and simulation software.
5. Develop teamwork, communication, and technical documentation skills.

Mini project work should consist of following steps

1. Students should propose project ideas & finalize the project idea in consultation with guide.
2. Students should submit implementation plan in the form of CPM (Critical Path Method chart) chart, which will cover weekly activity of project report.
3. Problem definition and specification development in the form of synopsis.
4. Design of circuit with calculation & should include materials used with their specification.
5. Design & assembly of hardware part of the mini project/Simulation of design using simulation softwares etc.
6. Testing & Validation of the result.

Course Outcomes:

1. Apply theoretical knowledge from core electrical and computer engineering subjects to solve practical, real-world problems.
2. Demonstrate proficiency in engineering design by developing small-scale projects using hardware/software tools and circuit simulation platforms.
3. Develop problem-solving and analytical skills by identifying, formulating, and implementing effective solutions in electrical engineering.
4. Apply project planning and management techniques, including time management, resource allocation, and progress tracking, in engineering tasks.
5. Foster innovation and creativity by encouraging the development of novel ideas, prototypes, or process improvements.

Note: -

1. Project report should include report of all above steps and conclusion.
2. Project group should demonstrate and deliver seminar on project.
3. A mini project should not exceed three students per group.

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Third Year B. Tech. Electrical and Computer Engineering

Semester – VI

Course Title		**Signals and Systems**		**Course Category**		**PCC**	
Contact Hrs/Week		**3**		**Course Code**		**ECE0**	
Teaching Scheme				**EXAM SCHEME**			
L	**T**	**P**	**Course Credits**	**MSE**	**ISE/CA**	**ESE**	**TOTAL**
3	**-**	**-**	**3**	**30**	**10**	**60**	**100**

Course Objectives:

- To understand basic of CT & DT signals and their representation.
- To understand basic of CT & DT system and their representation.
- To analyze CT & DT signals using Fourier transform.
- To understand Laplace and z-transforms as mathematical tool to analyze signals.
- To understand concept of sampling and reconstruction of signals.

Unit No and Title	**Contents**	**Hrs**
Unit-1	**Signals and Classification of Signals**: - Continuous time signals & discrete time, analog & digital, even &odd signals, periodic &non-periodic, deterministic &non-deterministic, energy & power, Basic CT & DT signals: unit impulse, unit step, unit ramp, complex exponential & sinusoidal, Basic operations on signals.	**6 Hrs**
Unit-2	**System and Classification of Systems: -** System Representation, continuous time Systems & discrete Systems, system with and without memory, causal and non-causal system, linear and nonlinear system, Time invariant and time variant system, convolution integral, convolution sum, properties of convolution.	**7 Hrs**
Unit-3	**Fourier Transform Fourier Transform: -** Fourier Transform of CT and DT signals, Properties of Fourier Transform, Fourier transform using properties, Limitations of Fourier Transform.	**7 Hrs**

Unit-4	**System analysis using Laplace transform**: -. A brief introduction to Laplace transform, ROC & its properties (problems on ROC), properties of Laplace transform, inverse Laplace transform (problems), solution of LTI differential equation with and without initial condition.	**7 Hrs**
Unit-5	**System analysis using Z-transform:** Introduction of Z-transform, ROC, properties of ROC, properties of Z transform, Inverse Z-transform: long division method, PFE method, residue method.	**7 Hrs**
Unit-6	**Sampling**: -Introduction to Sampling process, Sampling theorem, Reconstruction of signals from its sample's, aliasing, Sampling in the frequency domain.	**4 Hrs**

Course Outcomes:

At the end of the course the student will be able to:

- Students will able to understand different Signals, the basic operations that can be performed on signals and problems related to the signals.
- Apply convolution in both continuous and discrete domain for the analysis of systems
- Use Fourier transform for analysis of CT & DT signals.
- Make use of Laplace transform to analyze signals.
- Make use of Z transforms to analyze DT signals.
- Explain sampling theorem in time domain and frequency domain.

Text Books:

1. Linear systems and signals, B. P. Lathi, Oxford University Press, 2nd edition, 2005

2. Signals and systems, Simon Haykin, Wiley Publications

Reference Books:

1. Alan Oppenheim, Alan S. Willsky, "Signals and Systems", PHI Publication.

2. Simon Haykin, Barry Van Veen, "Signals and Systems", Wiley Publication

3. Michael J. Roberts, "Fundamentals of signals & systems", Tata McGraw Hill Publication,

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Semester –VI

Course Title		**Control System**		**Course Category**		**PCC**	
Contact Hrs /Week				**Course Code**		**ECE0236**	
Teaching Scheme				**EXAM SCHEME**			
L	**T**	**P**	**Course Credits**	**MSE**	**ISE/CA**	**ESE**	**TOTAL**
3	**1**	**--**	**4**	**30**	**10**	**60**	**100**

Course Objectives:

1) To explain the necessity of feedback and its application to the modelling of linear systems.
2) To obtain transfer function of systems through block diagram reduction and using Mason's gain formula
3) To discuss transient and steady state time response of a simple control system.
4) To discuss the stability of linear time invariant systems by Routh - Hurwitz criterion and root locus technique.
5) To analyse stability of a control system using Bode Plot and Nyquist plot.
6) To understand the concept of compensator design and state space analysis.

Unit No	**Contents**	**Hrs**
Unit-1	**Introduction to control systems:** Introduction, classification of control systems. **Mathematical models of physical systems:** Modelling of mechanical system elements, electrical systems, Analogous systems, Transfer function, Single input single output systems, Procedure for deriving transfer functions, servomotors, geartrains.	**7 Hrs**
Unit-2	**Block diagram:** Block diagram of a closed loop system, procedure for drawing block diagram and block diagram reduction to find transfer function**.** **Signal flow graphs:** Construction of signal flow graphs, basic properties of signal flow graph, Reduction using Mason's gain formula Transfer function of SFG's	**7 Hrs**
Unit-3	**Time Response Analysis Standard test signals –** Time response of first& second order systems –Design specifications of 2nd order system & error compensation, Characteristic Equation of Feedback control systems, Transient response of second order systems – Time domain specifications, Steady state response – Steady state errors and error constants.	**7 Hrs**
Unit-4	**Stability Analysis in S Domain:** BIBO stability, Necessary conditions for stability, Routh stability criterion, difficulties in formulation of Routh table, application of Routh stability criterion to linear feedback systems **Root locus technique:** Introduction, root locus concepts, construction of root loci, rules for the construction of root locus.	**7 Hrs**
Unit-5	**Frequency Response Analysis:** Introduction, Frequency domain specifications, Bode plot diagrams-Determination of Phase margin and Gain margin, Stability analysis from Bode plots.	**7 Hrs**

	Nyquist Stability Criterion: Nyquist plot & stability analysis.	
Unit-6	**Design of compensators:** Lead compensator, lag compensator, lead-lag/lag-lead compensators, their design. **State Space Analysis of Continuous Systems:** Concepts of state, state variables and state model, State Transition Matrix and it's properties, Concepts of Controllability and Observability.	**7 Hrs**

Course Outcomes:

1. To understand the concept of open loop and close loop system and Mathematical model of physical systems.
2. To Formulate transfer functions using block diagram and signal flow graphs.
3. Time response analysis of different order systems through their characteristic equation.
4. To understand the concept of stability and root locus concepts
5. To understand the basic concept of Frequency domain specifications.
6. To understand the basic concept of compensators and State Space Analysis.

Books:

1. Modern Control Systems by Richard C Dorf et al Pearson 11th Edition, 2008
2. Control Systems, Principles and Design by M.Gopal McGaw Hill 4 th Edition, 2012
3.

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Semester – VI

Course Title	**Computer Algorithm**	**Course Category**	**PCC**
Contact Hrs/Week	**3**	**Course Code**	**ECE0**

Teaching Scheme				**EXAM SCHEME**			
L	**T**	**P**	**Course Credits**	**MSE**	**ISE/CA**	**ESE**	**TOTAL**
3	**-**	**-**	**3**	**30**	**10**	**60**	**100**

Course Objectives:

1. Describe fundamentals of algorithms.
2. Discover solution to problems using algorithm design paradigms like Divide and Conquer and Greedy Approach.
3. Apply Dynamic Programming and Backtracking Approach to tackle the problems.
4. Analyze performance of algorithms using asymptotic analysis.

Unit No and Title	**Contents**	**Hrs**
Unit-1	**Fundamentals of Algorithms:** Introduction, Characteristics of algorithms, Pseudo code Conventions, Recursive Algorithms, Performance analysis, Asymptotic notations (O, Ω, Θ), Performance measurement, Randomized Algorithms, Recurrence relations, Sorting Techniques – Bubble Sort, Insertion Sort, Selection Sort, Radix Sort.	**6 Hrs**
Unit-2	**Divide and Conquer:** General method, Binary Search, Ternary Search, Finding the Maximum and Minimum, Merge Sort, Quick Sort, Selection, Convex Hull.	**6 Hrs**
Unit-3	**The Greedy Method:** General method, Knapsack Problem, Job Sequencing with Deadlines, Minimum-Cost Spanning Trees – Prim's and Kruskal's Algorithms, Optimal Storage on Tapes, Optimal Merge Patterns, Huffman codes, Single Source Shortest Paths.	**7 Hrs**
Unit-4	**Basic Traversal and Search Techniques:** Techniques for Binary trees, Game Tree, Techniques for Graphs – Breadth-First Search & Traversal, Depth First Search & Traversal, AND/OR graphs, connected components and Spanning Trees, Bi-connected components and depth-first search.	**8 Hrs**
Unit-5	**Backtracking:** General method, N-Queens Problem, Permutation Tree, Sum of Subsets, Graph Coloring, Hamiltonian Cycle, Knapsack Problem.	**6 Hrs**
Unit-6	**NP Hard and NP-Complete Problems:** Basic Concepts, Polynomial and Exponential Problems, Introduction to NP-Complete and NP-Hard Graph Problems.	**6 Hrs**

Course Outcomes:

At the end of the course, the student will be able to:

1. Understand and demonstrate algorithm design methods with analysis.
2. Devise algorithm for given problem statement and analyze its space and time complexity by using recurrence relation
3. Categorize the problem to determine polynomial and non-polynomial based on its Nature.

Books: Text Books

1. Fundamentals of Computer Algorithms Ellis Horowitz, Satraj Sahani, Saguthevar Rajasekaran University Press, Second Edition (All Units)

Reference Books

1. Data Structures and Algorithmic Thinking with PYTHON (Data Structure and Algorithmic Puzzles) Narasimha Karumanchi (MTech IIT Bombay) Career Monk Publications (Refer for String Algorithms in unit 5)
2. Fundamentals of Algorithms Gilles Brassard, Paul Bratley, Pearson Education.
3. Mastering Algorithms with CKyle Loudon SPDO' Reilly.
4. Computer Algorithms-Introduction to Design and Analysis Sara Baase, Allen VanGelder, Pearson Education.

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Semester – VI

Course Title		**Power System Stability & Control**		**Course Category**		**PEC-II**	
Contact Hrs/Week		**3**		**Course Code**		**ECE0**	
Teaching Scheme				**EXAM SCHEME**			
L	**T**	**P**	**Course Credits**	**MSE**	**ISE/CA**	**ESE**	**TOTAL**
3	**--**	**-**	**3**	**30**	**10**	**60**	**100**

Course Objectives:

1. To explain different types of stability problems.
2. To analyse the representation of synchronous machines in power system stability studies.
3. To understand the concept of small-signal stability and voltage stability.
4. To study different methods of voltage stability analysis.
5. To analyse the implementation of control strategies in HVDC converters and converter firing-control systems.
6. To understand the concepts of active power and frequency control.

Unit No and Title	**Contents**	**Hrs**
Unit-1	**Introduction to the power system stability problem:** Basic concepts and definitions, Rotor angle stability, Voltage stability and voltage collapse, Mid-term and long-term stability, Classification of stability, Historical review of stability problems.	**5 Hrs**
Unit-2	**Synchronous machine representation in stability studies:** Simplifications essential for large-scale studies, Neglect of stator $p\Psi$ terms, Neglecting the effect of speed variations on stator voltages, Simplified model with amortisseurs neglected, Constant flux linkage model, Classical model, Constant flux linkage model including the effects of sub transient circuits, Summary of simple models for different time frames, Reactive capability limits, Reactive capability curves, V curves and compounding curves	**6 Hrs**
Unit-3	**System Stability:** Small-signal stability of a single-machine infinite bus system, Generator represented by the classical model, Effects of synchronous machine field circuit dynamics, Effects of excitation system, Power system stabilizer. **Voltage stability:** Basic concepts related to voltage stability, Transmission system characteristics, Generator characteristics, Load characteristics, Typical scenario of voltage collapse.	**7 Hrs**
Unit-4	**Voltage stability analysis:** Modelling requirements, Dynamic analysis, Static analysis, Determination of shortest distance to instability, The continuation power-flow analysis, Prevention of voltage collapse, System design measures, System-operating measures.	**6 Hrs**
Unit-5	**Control of HVDC systems:** Basic principles of control, Control implementation, Converter firing-control systems, Valve blocking and bypassing, Starting, stopping, and power-flow reversal, Controls for enhancement of ac system performance.	**5 Hrs**

Unit-6	**Control of active power and reactive power:** Active power and frequency control, Fundamentals of speed governing, Control of generating unit power output, Composite regulating characteristic of power systems, Response rates of turbine-governing systems, Fundamentals of automatic generation control, Implementation of AGC, Under frequency load shedding, Reactive power and voltage control, Production and absorption of reactive power, Methods of voltage control, Shunt reactors, Shunt capacitors, Series capacitors, Modelling of reactive compensating devices.	**7 Hrs**

Course Outcomes: Learners will be able to

1. Explain the basic concepts and definitions of power system stability.
2. Explain the need for simplified synchronous machine models.
3. Explain the concept of small-signal stability and voltage stability.
4. Explain the static and dynamic voltage stability analysis methods.
5. Analyse the operation of converter control during different operating conditions.
6. Explain the principles of active power and frequency control in power systems.

Reference Books:

1. Power System Stability and Control Handbook – L. L. Grigsby, Publisher: CRC Press.
2. Power System Dynamics and Stability – Sauer & Pai, Publisher: Prentice Hall

Text Books:

1. "Power System Stability and Control" – Prabha Kundur, Publisher: McGraw-Hill
2. Power System Analysis – J. J. Grainger & W. D. Stevenson, Publisher: McGraw-Hill

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Third Year B. Tech. Electrical and Computer Engineering

Semester – VI

Course Title	**SWITCH GEAR & PROTECTION**			**Course Category**		**PEC-III**	
Contact Hrs/Week	**4**			**Course Code**		**ECE06**	
Teaching Scheme				**EXAM SCHEME**			
L	**T**	**P**	**Course Credits**	**MSE**	**ISE/CA**	**ESE**	**TOTAL**
3	**--**	**--**	**3**	**30**	**10**	**60**	**100**

Course Objectives:

1. To understand the need and basic principles of protection systems used in power systems to detect and isolate faults.
2. To understand the construction and operating principles of different types of protective relays used in power systems.
3. To study different overcurrent protective schemes and relays used for phase and earth fault protection.
4. To study protection schemes used for generators, transformers, and bus zones against internal and external faults.
5. To understand the construction, working principle, and types of circuit breakers used in power systems.
6. To understand the working principle, characteristics, and selection of different types of fuses used for power system protection.

Unit No and Title	**Contents**	**Hrs**
Unit-1	**Introduction to Power System Protection:** Need for protective schemes, Nature and Cause of Faults, Types of Faults, Effects of Faults, Fault Statistics, Zones of Protection, Primary and Backup Protection, Essential Qualities of Protection, Performance of Protective Relaying, Classification of Protective Relays, Automatic Reclosing, Current Transformers for protection, Voltage Transformers for Protection.	**5 Hrs**
Unit-2	**Relay Construction and Operating Principles:** Introduction, Electromechanical Relays, Static Relays – Merits and Demerits of Static Relays, Numerical Relays, Comparison between Electromechanical Relays and Numerical Relays.	**4 Hrs**
Unit-3	**Overcurrent Protection:** Introduction, Time – current Characteristics, Current Setting, Time Setting. Overcurrent Protective Schemes, Reverse Power or Directional Relay, Protection of Parallel Feeders, Protection of Ring Mains, Earth Fault and Phase Fault Protection, Combined Earth Fault and Phase Fault Protective Scheme, Phase Fault Protective Scheme, Directional Earth Fault Relay, Static Overcurrent Relays, Numerical Overcurrent Relays.	**7 Hrs**
Unit-4	**Differential Protection:** Introduction, Differential Relays, Simple Differential Protection, Percentage or Biased Differential Relay **Rotating Machines Protection:** Introduction, Protection of Generators-Sator & Rotor protection	**7 Hrs**

	Transformer and Bus zone Protection: Introduction, Transformer Protection-External & Internal Faults **Bus zone Protection**-Differential Current Protection, High Impedance Relay Scheme	
Unit-5	**Circuit Breakers:** Introduction, Fault Clearing Time of a Circuit Breaker, Arc Voltage, Arc Interruption, Restriking Voltage and Recovery Voltage, Current Chopping, Interruption of Capacitive Current, Classification of Circuit Breakers, Air – Break Circuit Breakers, Oil Circuit Breakers, Air – Blast Circuit Breakers, SF6 Circuit Breakers, Vacuum Circuit Breakers, High Voltage Direct Current Circuit Breakers, Rating of Circuit Breakers, Testing of Circuit Breakers.	**7 Hrs**
Unit-6	**Fuses:** Introductions, Definitions, Fuse Characteristics, Types of Fuses, Applications of HRC Fuses, Selection of Fuses, Discrimination. **Modern Trends in Power System Protection:** Introduction, gas insulated substation/switchgear (GIS), Advantages and Disadvantages of GIS	**5 Hrs**

Course Outcomes:

1. Explain the need for protective schemes and identify different types and causes of faults in a power system.
2. Describe the construction and operating principles of electromechanical, static, and numerical relays.
3. Apply different overcurrent protective schemes for phase fault and earth fault protection.
4. Explain the principle and application of differential protection for transformers, generators, and bus zones.
5. Explain the construction, types, and ratings of circuit breakers used in power systems.
6. Outline features of fuse, causes of over voltages and its protection, also modern trends in Power System Protection.

Reference Books:

1. Protection and Switchgear Bhavesh et al Oxford 1st Edition, 2011.
2. Power System Switchgear and Protection N. Veerappan S.R. Krishnamurthy S.Chand 1st Edition, 2009.
3. Fundamentals of Power System Protection Y.G.Paithankar S.R. BhidePHI 1st Edition, 2009**.**

Text Books:

1. Power System Protection and Switchgear, Badri Ram, D.N. Vishwakarma McGrawHill 2nd Edition.
2. Power System Protection and Switchgear, Bhuvanesh Oza et al McGraw Hill 1st Edition, 2010..

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Semester – VI

Course Title	Electrical Design Estimation & Costing			Course Category		MDM-04	
Contact Hrs/Week	3			Course Code		ECE0	
Teaching Scheme				EXAM SCHEME			
L	T	P	Course Credits	MSE	ISE/CA	ESE	TOTAL
2	-	-	2	30	10	60	100

Course Objectives:

1. This course is intended to provide basic knowledge of different material required for electrical installation
2. It intends to impart skills to select suitable electrical equipment's for installation.
3. It develops ability of estimate and costing of electrical installation.

Books:

Textbooks

1. A course in Electrical Installation, Estimating and costing, JB Gupta, S K Kataria and Sons.
2. Electrical Installation and Estimating, Surjit Singh, Dhanpat rai And Sons.
3. Electrical Design Estimating and Costing K. B. Raina, New Age International, 2007

Unit No and Title	Contents	Hrs
Unit-1	**Electrical Wiring** Different types of wires, wiring system and wiring methods, Comparison of different types of wiring, Specifications of Different types of wiring materials, Accessories Different types of wiring tools. Domestic and industrial panel wiring, different types of wiring circuit, I.E. rules for wiring, Electricity supplyact-1948	6 Hrs
Unit-2	**Elements of Estimating and concepts of contracting** Introduction to estimation & estimation tools, Electrical Schedule of rates, catalogues, Survey and source selection, recording estimates. Determination of required quantity of material, Labor conditions, Determination of cost material and labour, Contingencies, Overhead charges, Profit, Purchase system, Purchase enquiry and selection of appropriate purchase mode, Comparative statement, Purchase orders, Payment of bills, Terms, conditions, types of contract system. Tendering procedure and preparation of simple tender, Procedure for inviting and scrutinizing tender, Importance of Earnest Money Deposit, Security Deposit and S.O.R. Indian Electricity Act and major applicable I.E rules.	6 Hrs
Unit-3	**Estimating And Costing of Domestic and Industrial Wiring** Principles of circuit design in lighting and power circuits, Procedures for designing the circuits and deciding the number of circuits, Method of drawing single line diagram, Selection of type of wiring and rating of wires and cables, Load calculations and selection of size of conductor, Selection of rating of main switch, distribution board, protective	8 Hrs

	switchgear ELCB and MCB and wiring accessories, Earthing of residential Installation, Sequence to be followed for preparing estimate, Preparation of detailed estimates and costing of residential installation, Important considerations regarding motor installation wiring, Determination of input power, input current to motors, rating of cables, rating of fuse, size of Conduit, size of distribution Board, main switch and starter. Preparation of detailed estimates and costing industrial installation, I.E. rules observed for above wiring.	
Unit-4	**Estimating and Costing of Service Connection (Domestic and Industrial):** Concept of service connection, Types of service connection and their features, Method of installation of service connection (1-phase and 3-phase), Lay out/ wiring diagram of service connection list of materials and accessories along with specifications required for given installation work, Estimation of service connection for domestic and industrial (1-phase and 3-phase) I.E. rules pertaining to above wiring.	**7 Hrs**
Unit-5	**Estimation of Transmission line** Main components of overhead lines, Line supports, Factors governing height of pole, Conductor materials, Determination of size of conductor for overhead Transmission line, Cross arms, Pole brackets and clamps, Guys and Stays, Conductors configuration spacing and clearances, Span lengths, Overhead line insulators, Insulator materials Lightning Arrestors, Points to be considered at the time of erection of overhead lines, Erection of supports, Setting of stays, Earthing of lines, Guarding of overhead lines, Clearances of conductor from ground, Spacing between supports conductors, important specifications and sketches List of materials and accessories required for the given project estimate for material required I.E. rules pertaining to above project.	**5 Hrs**
Unit-6	**Estimation of Overhead and Underground Distribution System** Survey work for estimation of overhead and underground distribution system. Planning and layout of project. List of materials and accessories required for the given project. Procedure for preparing estimate for 440 V, 3-phase, 4 wire or 3 wire overhead and underground distribution system. Necessary drawing/sketches of overhead and underground system. I.E. rules pertaining to above project.	**4 Hrs**

Course Outcomes: At the end of the course, the student will be able to:

1. Explain & Evaluate concept of domestic and industrial wiring
2. Define & Explain concepts of Estimating and concepts of contracting
3. Analyze & Design Estimating and Costing of Domestic and Industrial Wiring
4. Explain & Evaluate concept Estimating and Costing of Service Connection
5. Analyze & Design Estimation of Transmission line
6. Analyze & Design Estimation of Overhead and Underground Distribution System

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Third Year B. Tech. Electrical and Computer Engineering

Semester – VI

Course Title		**Control System Lab**		**Course Category**		**PCC**	
Contact Hrs/Week		**2**		**Course Code**			
Teaching Scheme				**Exam Scheme**			
L	**T**	**P**	**Course Credits**	**MSE**	**ISE/CA**	**ESE**	**TOTAL**
--	**-**	**2**	**1**	**--**	**50**	**25**	**75**

Course Objectives:

1. To understand and apply block diagram reduction techniques for simplifying complex control systems and obtaining overall transfer functions.
2. To develop the ability to analyze systems using Signal Flow Graphs and apply Mason's Gain Formula.
3. To study the concept of poles and zeros and their effect on system behavior using simulation tools.
4. To analyze the time response of second-order systems, especially underdamped systems for different damping ratios.
5. To understand and interpret the frequency response characteristics of second-order systems.
6. To study the design and performance of lead and lag compensators in frequency domain analysis.
7. To evaluate system stability using analytical methods such as the Routh Stability Criterion.
8. To analyze system stability and performance using Root Locus techniques.
9. To assess stability and performance using Bode Plot analysis and frequency response methods.

S.No.	**Experiments**
1	Implement Block diagram reduction technique to obtain transfer function a control system.
2	Implement Signal Flow graph to obtain transfer function of a control system.
3	Simulation of poles and zeros of a transfer function.
4	Implement time response specification of a second order Under damped System, for different damping factors.
5	Implement frequency response of a second order System.
6	Implement frequency response of a lead lag compensator.
7	Analyze the stability of the given system using Routh stability criterion.

8	Analyse the stability of the given system using Root locus.
9	Analyse the stability of the given system using Bode plots

Course Outcomes:

At the end of the course, the student will be able to:

1. Simplify complex control systems and compute transfer functions using block diagram reduction methods.
2. Apply Signal Flow Graph techniques and Mason's Gain Formula to determine system transfer functions.
3. Analyze and interpret the role of poles and zeros in determining system stability and response.
4. Evaluate time domain specifications such as rise time, settling time, peak time, and overshoot for second-order systems with varying damping factors.
5. Interpret frequency response plots (magnitude and phase) of second-order systems.
6. Design and analyze lead and lag compensators to improve system performance.
7. Determine system stability using the Routh-Hurwitz stability criterion.
8. Analyze system stability and transient behavior using the Root Locus method.
9. Evaluate system stability margins and performance using Bode plots.

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Semester –VI

Course Title			**Computer Algorithms Lab**	**Course Category**			**PCC**
Contact Hrs/Week			**2**	**Course Code**			**ECE**
Teaching Scheme				**Exam Scheme**			
L	**T**	**P**	**Course Credits**	**MSE**	**ISE/CA**	**ESE**	**TOTAL**
--	**-**	**2**	**1**	**--**	**50**	**25**	**75**

Course Objectives:

1. To introduce algorithm design methods/techniques with analysis.
2. To devise algorithm for given problem statement and compute its complexity.
3. To introduce complex computational problems.

Sr.No.	**Experiments**
1	Implementation and analysis of Binary search algorithm.
2	Implementation and analysis of Finding the maximum and minimum among the given list of integers.
3	Implementation and analysis of Merge sort algorithm.
4	Implementation and analysis of Quick Sort algorithm.
5	Implementation and analysis of DC Selection Algorithm.
6	Implementation of Knapsack problem.
7	Implementation of Job sequencing with deadlines.
8	Implementation of Prim's and Kruskal's algorithms.
9	Implementation of Optimal Merge Patterns.
10	Implementation of Single source shortest paths.
11	Implementation of All pair shortest paths.
12	Implementation of Breadth First Search and Depth First Search.

Course Outcomes: At the end of the course, the student will be able to:

1. Understand and demonstrate algorithm design methods with analysis.
2. Devise algorithm for given problem statement and analyse its space and time complexity by using recurrence relation.
3. Categorize the problem to determine polynomial and non- polynomial based on its Nature

Text Books:

1. Fundamentals of Computer Algorithms Ellis Horowitz, Satraj Sahani, Saguthevar Rajasekaran University Press, Second Edition (All Units)

Reference Books:

1. Data Structures and Algorithmic Thinking with PYTHON (Data Structure and Algorithmic Puzzles) Narasimha Karumanchi (MTech IIT Bombay)Career Monk Publications(Refer for String Algorithms in unit 5)
2. Fundamentals of Algorithms GillesBrassard, PaulBratley.PearsonEducation.
3. Mastering Algorithms with CKyle Loudon SPDO'Reilly.
4. Computer Algorithms-Introduction to Design and Analysis Sara Baase, Allen VanGelder, Pearson Education.
5. Thomas H.Cormen, Charles E.Leiserson, RonaldL.Rivestand CliffordStein, "Introduction to Algorithms," Third Edition PHI 2010.

Online Resources:

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Third Year B. Tech. Electrical and Computer Engineering

Semester – VI

Course Title	**Minor Project 01**	**Course Category**	**EL**
Contact Hrs/Week	**2**	**Course Code**	

Teaching Scheme				**EXAM SCHEME**			
L	**T**	**P**	**Course Credits**	**MSE**	**ISE/CA**	**ESE**	**TOTAL**
--	**-**	**2**	**1**	**---**	**50**	**---**	**50**

Course Objectives:

1. Identify simple real-world engineering problems related to electrical and computer systems.
2. Apply basic concepts of electrical, electronics, and programming to develop solutions.
3. Design and implement small-scale hardware/software-based systems.
4. Gain hands-on experience with tools, components, and simulation software.
5. Develop teamwork, communication, and technical documentation skills.

Mini project work should consist of following steps

1. Students should propose project ideas & finalize the project idea in consultation with guide.
2. Students should submit implementation plan in the form of CPM (Critical Path Method chart) chart, which will cover weekly activity of project report.
3. Problem definition and specification development in the form of synopsis.
4. Design of circuit with calculation & should include materials used with their specification.
5. Design & assembly of hardware part of the mini project/Simulation of design using simulation softwares etc.
6. Testing & Validation of the result.

Course Outcomes:

1. Apply theoretical knowledge from core electrical and computer engineering subjects to solve practical, real-world problems.
2. Demonstrate proficiency in engineering design by developing small-scale projects using hardware/software tools and circuit simulation platforms.
3. Develop problem-solving and analytical skills by identifying, formulating, and implementing effective solutions in electrical engineering.
4. Apply project planning and management techniques, including time management, resource allocation, and progress tracking, in engineering tasks.
5. Foster innovation and creativity by encouraging the development of novel ideas, prototypes, or process improvements.

Note: -

1. Project report should include report of all above steps and conclusion.
2. Project group should demonstrate and deliver seminar on project.
3. A mini project should not exceed three students per group.