COCHIN UNIVERSITY OF SCIENCE AND TECHNOLOGY

(Abstract)

Faculty of Technology -Amendment to B.Tech NA&SB Regulations (2024 Scheme) - Resolution of the Academic Council - Communicated - Orders issued.

ACADEMIC A SECTION

No.CUSAT/AC(A).A3/4989/2024 Dated,KOCHI-22,11.11.2024

Read:-Item No. I (f) (1) of the minutes of the meeting of the Academic Council held on 07.09.2024

ORDER

The Academic Council, vide item read above, considered along with the recommendations of it's standing committee, the Minutes of the Faculty of Technology held on 30.08.2024 and resolved to approve the following :

a. To amend the Clause 4.2.2 of B.Tech NA & SB Regulations (2024 Scheme) as:

"To pass in a course, a candidate has to score not less than 40% of marks in the end semester examination and not less than 50% aggregate marks in the end semester examination and continuous assessment put together. There shall be no moderation for the examinations".

b. Also resolved to amend Clause 5.4 of B.Tech NA & SB Regulation (2024 Scheme) as:

"A student shall be given one regular and one supplementary chance for the semester end examination for a particular semester in both theory and practical courses to obtain a pass grade before he/she is assessed for promotion to higher semesters".

Rules for promotion are applicable only to the V^{th} and VII^{th} semesters and shall be as follows:-

Minimum number of credits to be earned for promotion to V^{th} semester (n=5) and to VII^{th} semester (n=7) should be (n-3) x 10 credits obtained from semester I and upto and including semester (n-3).

The revised regulations for B.Tech NA & SB (2024) incorporating the above amendments

are appended

Orders are, therefore, issued accordingly.

Dr. Arun A U *

Registrar

To:

1. The Dean, Faculty of Technology
2. The Chairperson, BoS in Naval Architecture & Ship Building
3. The Head, Deparftment of Ship Technology
4. All AR/DR Examination wing - with a request to forward to sections concerned
5. The Director, IQAC/ DoA
6. CIRM/Conference Sections
7. PS To VC/PVC;PA To Registrar/CE.

* This is a computer generated document. Hence no signature is required.

Appendix - XXI

DEPARTMENT OF SHIP TECHNOLOGY

B.Tech And B.Tech (Honours) Degree Programme In

NAVAL ARCHITECTURE & SHIP BUILDING

(8 SEMESTER DURATION) WITH EFFECT FROM 2024 UNDER OBE SYSTEM

Regulations

COCHIN UNIVERSITY OF SCIENCE & TECHNOLOGY

Kalamassery, Cochin – 682022 Kerala, India

Phone: 0484 – 2577290

Fax: 084-2577550

Web: www.cusat.ac.in

REGULATIONS FOR B. Tech AND B. Tech (HONOURS) DEGREE PROGRAMME IN NAVAL ARCHITECTURE & SHIP BUILDING

1. **Programme of Study:**

1.1 The Programme for the B. Tech degree shall extend over a period of four academic years comprising eight semesters each of four months duration (approx.16 weeks).

1.2 The programme of study shall follow a credit system and will be in accordance with the scheme, course content and syllabus prescribed. **The total credit for the entire course shall be 180.**
Additional credits to be earned by students opting for B.Tech (Honours) shall be 18 (total 198 credits)

1.3 The programme of instruction shall consist of the following:

1.3.1 Humanities and management courses, Basic science courses, basic engineering courses, professional core courses, professional electives and industrial electives related to Naval Architecture and Shipbuilding.

1.3.2 Workshop practice, laboratory works, Internship, Project work

1.3.3 Mandatory Non-Credit course in Environmental studies

1.3.4 At least one elective course with minimum 2 credits as MOOC courses, hosted in SWAYAM platform/ offered by CUSAT/ platforms in online mode by other post graduate institutions in INDIA or abroad, be taken by students after approval from Department Council (DC).

1.3.5 Elective courses (In house electives /Industrial electives /Open electives) enable the students to opt for specialised courses related to the profession. The electives will be identified and approved by the DC before commencement of courses.

1.3.6 The industrial elective will be offered jointly with an industry. The evaluation will be done jointly with the industry in a method mutually agreed upon.

1.4 Training and regular visits to the industry will also form part of the programme. Every academic year, except in the final year, the students will undergo internship for a period of 4 - 6 weeks duration in shipyards, ship repair firms and related industries. Credits for the internship will be counted in the subsequent odd semesters (i.e., III, V or VII semesters).

2. Eligibility for the B.Tech Degree:

2.1 No candidate shall be eligible for the B. Tech Degree in Naval Architecture and Shipbuilding unless he / she has undergone the prescribed programme of study for a period not less than 4 academic years from the date of admission to the first semester and has passed the prescribed examinations in all the semesters.

2.2 A Student should complete the prescribed programme of study within eight academic years from date of first admission to the programme.

2.3 Each student shall secure 180 credits for the completion of the undergraduate program and award of BTech degree.

3 Rules regarding Attendance:

3.1 Every candidate is required to secure a minimum of 75% attendance overall considering all the subjects in the semester to be eligible for appearing for the University examinations.

3.2 The Vice Chancellor shall have the power to condone shortage of attendance up to 10 percent on medical grounds on the recommendation of the Head of Department. However, such condonation for shortage of attendance shall be given only twice during the entire programme.

4 Rules for Examination:

4.1 Internal Assessment: -

4.1.1 All sessional works shall be evaluated and marks shall be awarded on the basis of day-to day work, periodic tests and regular assignments based on the scheme of evaluation as decided by the Department Council.

4.1.2 The total sessional marks for theory and laboratory courses shall be made up of 50% for internal tests (minimum two tests), 40% for assignments / quizzes / seminars and 10% for attendance. However, the teachers, depending upon the specific requirements of the subjects, can make changes in the distribution with the permission of the Head of the Department. Marks for attendance shall be awarded as follows:

% of Attendance	Marks Awarded
96-100	10
91–95	8
86–90	6
81–85	4
75–80	2
below 75	0

4.1.3 There will be no continuous assessment mark for online courses. The total marks for the course will be assigned as end semester marks out of 100 against the course.

4.1.4 A candidate shall be allowed to improve internal assessment marks in theory/laboratory courses prior to or after the course completion, subject to the following conditions: -

- The candidate shall be allowed to improve the internal assessment marks in

a particular course only once.

- The candidate shall not be allowed to improve the internal assessment marks of any course if the candidate has already passed the course.
- Moderation of marks given during the final pass board of any semester will not be applied to the internal assessment marks.

4.2 External Assessment: -

4.2.1 The University Examination shall be conducted at the end of every semester in the courses as prescribed under the course content.

4.2.2 To pass in a course, a candidate has to score not less than **40%** of the marks in the end semester examination and not less than **50%** aggregate marks in the end semester examination and continuous assessment put together. There shall be no moderation for the examinations.

4.2.3 In courses where there are no University examinations, a candidate has to score not less than 50% sessional marks for a pass in that course.

4.2.4 A student should score a minimum of 50% marks to get a pass in the registered online course irrespective of the pass percentage specified by the host institution. Those who fail to get 50% marks will have to repeat the same online course or do another online course with the approval of the department council. No internal exam /makeup exam / supplementary exam will be conducted by the department for online courses.

5 Rules for Promotion:

5.1 A student will be eligible to be promoted from one semester to the next semester only if the candidate has secured a minimum of 75% attendance overall

5.2 Each candidate shall register for the examination at the end of each semester.

5.3 A candidate shall not register for the n^{th} semester examination without registering for (n-1) th semester

5.4 A student shall be given one regular and one supplementary chance for the semester end examination for a particular semester in both theory and practical courses to obtain a pass grade before he/ she is assessed for promotion to higher semesters.

Rules for promotion is applicable only to the **V^{th}** and **VII^{th}** semesters and shall be as follows:-

Minimum number of credits to be earned for promotion to V^{th} semester (n = 5) and to VII^{th} semester (n =7) should be (n-3) x 10 credits obtained from semester I and upto and including semester (n-3).

6 Rules for B.Tech (Honours):

6.1 Honours is an additional credential a student may earn if he/she acquires the extra 18 credits apart from the credits required for the B.Tech program. B.Tech students with a minimum CGPA of 8.0 and above obtained in the first attempt in the first and second years combined are eligible to register for B.Tech. (Honours).

6.2 The CGPA of the candidate at the end of eighth semester shall be 8.0 or higher to be eligible for the award of B. Tech. (Honours).

6.3 The B.Tech. (Honours) registration shall be along with the registration of the 5th semester.

6.4 If a student fails in any course of the B.Tech. programme or the courses chosen for B.Tech. (Honours), he/she shall not be eligible to continue the B.Tech. (Honours).

6.5 The student shall earn a minimum of additional 18 credits from the courses chosen for B.Tech. (Honours), to be eligible for the award of B.Tech. (Honours) Degree.

6.6 For CGPA calculation of B.Tech. programme as per the provision of section 8, the credits earned by the student for his/her Honours programme will not be considered.

6.7 There shall be no transfer of credits from courses of Honours programme to regular B. Tech. programme and vice versa.

6.8 All additional 18 credits shall be earned through successfully completing the Courses/mini projects in the 5th, 6th , 7th and 8th semesters. The break up of credits and broad area for the projects shall be carried out as follows (details shall be specified in the syllabus for the respective semesters). Students are encouraged to carry out mini projects from Industries/ Research Institutions also.

Semester	Title	Credits	Description
V	**Course I (H)**	**3**	To be completed in core areas as MOOC courses with minimum 3 credits, hosted in SWAYAM platform/ offered by CUSAT in offline/online mode after approval from Department Council (DC)
VI	**Course II (H)**	**3**	
VII	**Mini Project I (H)**	**6**	Broad Areas: Fluid Mechanics, Stability, Material Science, Applied Mechanics, Thermal Engineering, Ship Dynamics (Powering, Ship Motions, Controllability), Electrical/ Control Systems in Ships/ Shipyards, Marine Engineering
VIII	**Mini Project II (H)**	**6**	Broad Areas: Numerical Analysis (FEA or CFD), Marine Hydrodynamics, Ship Design, Green Technology, Ship Production, Heating Ventilating and Air Conditioning (HVAC) system design.

6.9 Credits for the B.Tech.(Honours) courses are deemed to be earned only on getting a "C" grade or better as per the provisions of section 8.1.

6.10 The maximum number of additional credits a student can register (course registration) in a semester is limited to 6 credits in excess of the mandatory credits allotted in the curriculum for that semester.

6.11 The assessment of the mini projects for earning credits shall be carried out by a department committee consisting of at least three faculty members. Representatives from industry/Research Institutions also to be included in the committee in the case of an external projects.

6.12 B.Tech. (Honours) Degree shall be awarded by the University to the students who fulfill all the academic eligibility requirements for the B.Tech. and B.Tech. (Honours) programme.

6.13 Students opting for B.Tech. (Honours) have to pay requisite fees for additional courses.

7 Rules for Readmission:

7.1 A Student who is unable to attend classes on medical or other genuine grounds may be readmitted to the respective semester along with the subsequent batch.

7.2 A student seeking readmission shall give a written application to the Head of the Department, sixty days prior to the commencement of the semester to which readmission is sought.

7.3 A Student who has been removed from the nominal rolls due to default in payment of the semester fees shall be readmitted subject to the following conditions:

- The Head of the Department can readmit the student within 10 days from the last date of payment of the semester fees.
- Thereafter the University may accord sanction for readmission.
- Readmission can be given only if the student can secure a minimum of 75% attendance in each course meeting the eligibility to register for the University examination of the respective semester.

8 Grading:

8.1 Grades shall be awarded to the candidates in each course based on the total marks obtained in the internal and external assessments as follows:

Marks obtained (Percentage)	**Grade**	**Grade Points**
90-100	S	10
80 to less than 90	A	9
70 to less than 80	B	8
60 to less than 70	C	7
50 to less than 60	D	6
Less than 50	F	0

8.2 A student is considered to have credited a course or earned credits in respect of the course if the student secures a grade other than F for that course.

8.3 Grade Point Average (GPA):

a.) The academic performance of a student in a semester is indicated by the Grade Point Average (GPA)

$$\text{GPA} = \frac{G1C1+G2C2+G3C3+\ldots\ldots\ldots GnCn}{C1+C2+C3+\ldots\ldots\ldots\ldots\ldots Cn}$$

where G refers to the grade point and C refers to the credit value of corresponding course undergone by the student.

b.) The cumulative Grade Point Average (CGPA) will be calculated as

$$\textbf{CGPA} = \frac{S1T1+S2T2+S3T3+\ldots\ldots\ldots SnTn}{T1+T2+T3+\ldots\ldots\ldots\ldots Tn}$$

where 'S' refers to the Grade Point Average, 'T' refers to the total credits in that semester.

8.4 Grade Card:

The Grade Card issued at the end of the semester to each student by the Controller of Examinations, will contain the following: -

a. The code, title, number of credits of each course registered in the semester, marks (internal, external, total, month & year of passing the subject)
b. The letter grade obtained (grade number)
c. The total number of credits earned by the student upto the end of that semester
d. GPA & CGPA (CGPA for final semester only)
e. Details of Honours courses passed

9 Overall Classification:

9.1 ***B.Tech First Class with Distinction***: - Candidates who qualify for the Degree passing all the examinations within 4 academic years after the commencement of the programme of study and securing a CGPA of 8 and above. However, if a candidate has a CGPA of 8 and above, but is not able to complete within 4 years, such candidate is eligible to be classified as First class only.

9.2 ***B.Tech First Class: -*** Candidates who qualify for the Degree passing all the examinations within 8 academic years after their commencement of the programme of study and securing a CGPA of 6.5 and above.

9.3 ***B.Tech Second Class:*** Candidates who qualify for the Degree passing all the examinations within 8 academic years after the commencement of the programme of study and securing a CGPA of 6 and above but less than 6.5.

9.4 ***B.Tech (Honours):*** Candidate who qualifies for B.Tech First Class with Distinction and satisfy all the conditions as per section 6.

10 Revision of Regulation and Curriculum:

The University may from time-to-time revise, amend or change the Regulations, Curriculum, Scheme of Examination and Syllabus.

MISSION AND VISION

VISION

To evolve into a globally recognized department in the frontier areas of Naval Architecture and Ship Building.

MISSION

As a department, we are committed to

- Achieve academic excellence in the field of Naval Architecture and Ship Building through innovative teaching and learning processes.
- To prepare the students to be professionally competent to face the challenges in academics, industry and research.
- Promote inter-disciplinary research among the faculty and the students to create state of art research facilities.
- To promote quality and ethics among the students.
- Motivate the students to acquire entrepreneurial skills to become global leaders.

Program Educational Objectives (PEOs)

It is expected that students of B.Tech Naval Architecture & Ship Building will have acquired certain characteristics which will enable them utilize it in their careers. They are:

PEO 1	Utilizing strong technical aptitude and domain knowledge **to develop smart solutions for design and construction** of marine vehicle and structure and consequently **contribute to the economic progress** and general the upliftment of society.
PEO 2	Applying **research and entrepreneurial skills** augmented with a rich set of communication, teamwork and leadership skills to excel in their profession.
PEO 3	Showing **continuous improvement** in their professional career through life-long learning, appreciating human values and ethics.

Program Outcomes

Engineering Graduates will be able to:

PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Objectives (PSOs)

On completion of Naval Architecture and Shipbuilding Programme, the NA & SB graduates are expected to:

PSO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization in the solution of complex Naval Architecture and shipbuilding problems.
PSO 2	**Problem analysis**: Identify, formulate, review research literature, and analyse complex Naval Architecture and shipbuilding problems to reach substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PSO 3	**Design/development of solutions**: Design solutions for complex Naval Architecture and shipbuilding problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and the cultural, societal, and environmental factors
PSO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

Bloom's Category Assessment for Course Outcome

Level	Description	Sample
Remember	Recognizes students 'ability to use rote memorization and recall certain facts	Define, cite, name, recall, list, state, write
Understand	Involves students 'ability to read course content, understand and interpret important information and put other 's ideas into their own words	Describe, explain, identify, summarise, discuss, outline
Apply	Students take new concepts and apply them to another situation	Demonstrate, illustrate, interpret, solve, use, examine
Analyze	Students have the ability to take new information and break it down into parts to differentiate between them	Compare, contrast, distinguish, examine, identify, categorise, investigate
Evaluate	Involves students 'ability to look at someone else's ideas or principles and see the worth of the work and the value of the conclusions	Appraise, defend, support, value, justify, assess, inspect, recommend
Create	Students are able to take various pieces of information and form a whole creating a pattern where one did not previously exist	Assemble, construct, design, develop, create, plan, invent, synthesise

COURSE CATEGORIES AND CREDIT REQUIREMENTS:

Total credits for completing B.Tech in Naval Architecture and Ship Building: 180.

Additional Credit requirement for BTech Honors in Naval Architecture and Ship Building:18

The structure of B. Tech programme in Naval Architecture and Ship Building shall have the following **Course Categories**:

Sl. No.	Course Category	Number of Courses	Credits
1	Basic Science Courses **(BSC)**	**6**	**18**
2	Engineering Science Courses **(ESC)**	**19**	**52**
3	Humanities & Management Courses **(HMC)**	**3**	**4**
4	Professional Core Course **(PCC)**	**26**	**90**
5	Professional Elective Course **(PEC)**	**4**	**16**

COURSE REQUIREMENTS

The effort to be put in by the student is indicated in the tables below as follows:

L: Lecture (One unit is of one-hour duration)

T: Tutorial (One unit is of one-hour duration)

P: Practical (One unit is of one-hour duration)

PROGRAMME STRUCTURE

SEMESTER I

Subject Code	Subject	Category	Hrs / Week				Credit	Marks		
			L	T	P	Total		University	Internal	Total
24-215-0101	Technical Communication	HMC	2	1	1	4	2	100	100	200
24-215-0102	Mathematics I	BSC	3	1		4	3	100	100	200
24-215-0103	Engineering Physics	BSC	3	1		4	3	100	100	200
24-215-0104	Introduction to Naval Architecture	PCC	3	1	1	5	3	100	100	200
24-215-0105	Engineering Mechanics	ESC	3	1		4	3	100	100	200
24-215-0106	Programming in Engineering	ESC	2	1	2	5	3	100	100	200
24-215-0107	Workshop Practice I	ESC			4	4	2		50	50
Total			**16**	**6**	**8**	**30**	**19**	**600**	**650**	**1250**

SEMESTER II

Subject Code	Subject	Category	Hrs / Week				Credit	Marks		
			L	T	P	Total		University	Internal	Total
24-215-0201	Mathematics II	BSC	3	1		4	3	100	100	200
24-215-0202	Basic Ship Theory	PCC	3	1	1	5	3	100	100	200
24-215-0203	Electrical Engineering	ESC	3	1		4	3	100	100	200
24-215-0204	Mechanics of Solids	ESC	3	1		4	3	100	100	200
24-215-0205	Engineering Graphics	ESC	2	2	1	5	3	100	100	200
24-215-0206	Engineering Chemistry	BSC	3	1		4	3	100	100	200
24-215-0207	Workshop Practice II	ESC			4	4	2		50	50
Total			**17**	**7**	**6**	**30**	**20**	**600**	**650**	**1250**

SEMESTER III

Subject Code	Subject	Category	Hrs / Week				Credit	Marks		
			L	T	P	Total		University	Internal	Total
24-215-0301	Mathematics III	BSC	3	1		4	3	100	100	200
24-215-0302	Fluid Mechanics I	ESC	3	1		4	3	100	100	200
24-215-0303	Professional Ethics and Universal Human Values	HMC	2	1		3	2	100	100	200
24-215-0304	Instrumentation	ESC	3	1		4	3	100	100	200
24-215-0305	Analysis of Structures	ESC	3	1		4	3	100	100	200
24-215-0306	Machine Drawing	ESC	1	3		4	3	100	100	200
24-215-0307	Stability of Ships	PCC	3	1		4	3	100	100	200
24-215-0308	Electrical Engineering Lab	ESC			3	3	2		50	50
24-215-0309	Internship	PCC					2		50	50
Total			**18**	**9**	**3**	**30**	**24**	**700**	**800**	**1500**

SEMESTER IV

Subject Code	Subject	Category	Hrs / Week				Credit	Marks		
			L	T	P	Total		University	Internal	Total
24-215-0401	Mathematics IV(Numerical Methods in Engineering)	BSC	3	1		4	3	100	100	200
24-215-0402	Resistance of Ships	PCC	3	1		4	3	100	100	200
24-215-0403	Fluid Mechanics II	ESC	3	1		4	3	100	100	200
24-215-0404	Design of Machine Elements	ESC	2	2		4	3	100	100	200
24-215-0405	Applied Thermodynamics	ESC	3	1		4	3	100	100	200
24-215-0406	Materials Science	ESC	3	1		4	3	100	100	200
24-215-0407	Fluid Mechanics Lab	ESC	1		2	3	2		50	50
24-215-0408	Model Making Techniques Lab	PCC			3	3	2		50	50
Total			**18**	**7**	**5**	**30**	**22**	**600**	**700**	**1300**

SEMESTER V

Subject Code	Subject	Category	Hrs / Week				Credit	Marks		
			L	T	P	Total		University	Internal	Total
24-215-0501	Propulsion of Ships	PCC	3	1		4	3	100	100	200
24-215-0502	Ship Motions in Seaway	PCC	3	1		4	3	100	100	200
24-215-0503	Marine Engineering	PCC	3	1		4	3	100	100	200
24-215-0504	Ship Structural Analysis I	PCC	3	1		4	4	100	100	200
24-215-0505	Structural Design of Ships	PCC	3	1		4	4	100	100	200
24-215-0506	Marine Hydrostatics & Hydrodynamics Lab	PCC			4	4	2		50	50
24-215-0507	Material Testing Lab	ESC			4	4	2		50	50
24-215-0508	Environmental Studies	HMC	1	1		2	0		50	50
24-215-0509	Internship	PCC					2		50	50
Total			**16**	**6**	**8**	**30**	**23**	**500**	**700**	**1200**
24-215-0510	Course I (H)	PCC					3	100		100

SEMESTER VI

Subject Code	Subject	Category	Hrs / Week				Credit	Marks		
			L	T	P	Total		University	Internal	Total
24-215-0601	Joining Techniques in Ship building Technology	PCC	3	1		4	3	100	100	200
24-215-0602	Controllability of Ships	PCC	3	1	1	5	3	100	100	200
24-215-0603	Ship Production Technology	PCC	3		1	4	4	100	100	200
24-215-0604	Ship Design	PCC	3	1	1	5	3	100	100	200
24-215-0605	Electrical Systems on Ships and Shipyards	ESC	3	1		4	3	100	100	200
24-215-0606	Ship Structural Analysis II	PCC	3	1		4	4	100	100	200
24-215-0607	Marine Engineering Lab	PCC	1		3	4	2		50	50
Total			**19**	**5**	**6**	**30**	**22**	**600**	**650**	**1250**
24-215-0608	Course II (H)	PCC					3	100		100

SEMESTER VII

Subject Code	Subject	Category	Hrs / Week				Credit	Marks		
			L	T	P	Total		University	Internal	Total
24-215-0701	Ship Production Management	PCC	3	1		4	4	100	100	200
24-215-0702	Practical Ship Design	PCC	3	1		4	3	100	100	200
24-215-0703	Computational Hydrodynamics and Structural Engineering	PCC	3	1		4	3	100	100	200
24-215-0704	Project Work Phase I	PCC	2	2	6	10	6		400	400
24-215-0705	Internship	PCC				0	2		50	50
	Elective I	PEC	3	1		4	4	100	100	200
	Elective II	PEC	3	1		4	4	100	100	200
Total			**17**	**7**	**6**	**30**	**26**	**500**	**950**	**1450**
24-215-0714	Mini Project I **(H)**	PCC			6	6	6		100	100

List of Electives Semester VII

24-215-0706 Marine Corrosion and Prevention

24-215-0707 Design of Fishing Vessels

24-215-0708 Refrigeration and Airconditioning of Ships

24-215-0709 Offshore Structure Design

24-215-0710 Ship Recycling

24-215-0711 Maritime Engineering Contracts and Commercial Management

24-215-0712 Composite Boat Design

24-215-0713 Computer Aided Design & Drafting

SEMESTER VIII

Subject Code	Subject	Category	Hrs / Week				Credit	Marks		
			L	T	P	Total		University	Internal	Total
24-215-0801	Special Problem & Seminar	PCC		2		2	2		50	50
24-215-0802	Project Work Phase II & Viva	PCC	8	2	10	20	14	300	500	800
	Elective III	PEC	3	1		4	4	100	100	200
	Elective IV	PEC	3	1		4	4	100	100	200
Total			**14**	**6**	**10**	**30**	**24**	**500**	**750**	**1250**
24-215-0810	Mini Project II **(H)**	PCC			6	6	6		100	100

List Of Electives Semester VIII

24-215-0803 Experimental Techniques on ships and models

24-215-0804 Finite Element Methods and Applications

24-215-0805 Ship Repairing and Surveying

24-215-0806 Marine Pollution Prevention and Management

24-215-0807 Inland water Transport

24-215-0808 Artificial intelligence in marine Technology

24-215-0809 Advanced Computational Fluid Dynamics in Marine Technology

Total Credits:	**180**
Total Internal Exam mark:	**5850**
Total university Exam Mark:	**4600**
Grand Total marks:	**10450**
Additional credit for Honors:	**18**

SEMESTER I

24-215-0101 TECHNICAL COMMUNICATION

Course Description: To provide an overview on the importance of communication and to improve soft skills of students.

24-215-0101	Technical Communication	Category	L	T	P	Credit	Year of Induction
		HMC	2	1	1	2	2024

Pre-requisites: Nil

Course Objectives: To provide knowledge on effective technical communication methods and to provide a platform for improving soft skills

Course outcome: After the completion of the course the students will be able to

CO 1	Develop vocabulary and language skills relevant to engineering as a profession
CO 2	Analyse, interpret and effectively summarize a variety of textual content
CO 3	Students will able to know how to read a journal paper
CO 4	Students will able to write a scientific paper
CO 5	Students will able to effectively communicate with scientific and professional society

Mapping of course outcomes with PO: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	1								3			3
CO 2	1								2			3
CO 3	2											
CO 4	2	1										1
CO 5	1							2				2

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Exam
	1	2	
Remember	15	15	20
Understand	10	10	50
Apply	25	25	30
Analyse			
Evaluate			

Mark distribution

Ttal Marks	CIE	ESE	ESE Duration
200	100	100	3 hours

24-215-0101 TECHNICAL COMMUNICATION

Course Content

Module I
Fundamentals of Technical Communication: Technical Communication: Features; Distinction between General and Technical Communication; Language as a tool of Communication; Dimensions of Communication: Reading & comprehension; Technical writing: sentences; Paragraph; Technical style: Definition, types & Methods; The flow of Communication: Downward; upward, Lateral or Horizontal; Barriers to Communication

Module II
Forms of Technical Communication: Technical Report: Definition & importance; Thesis/Project writing: structure & importance; synopsis writing: Methods; Technical research Paper writing: Methods & style; Seminar & Conference paper writing; Key-Note Speech: Introduction & Summarization; Expert Technical Lecture: Theme clarity; Analysis & Findings; 7 Cs of effective business writing: concreteness, completeness, clarity, conciseness, courtesy, correctness, consideration.

Module III
Technical Presentation, Strategies & Techniques: Presentation: Forms; interpersonal Communication; Class room presentation; style; method; Individual conferencing: essentials: Public Speaking: method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation; Overcoming Stage Fear: Confident speaking; Audience Analysis & retention of audience interest; Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections.

Module IV
Technical Communication Skills: Interview skills; Group Discussion: Objective & Method; Seminar/Conferences Presentation skills: Focus; Content; Style; Argumentation skills: Devices: Analysis; Cohesion & Emphasis; Critical thinking; Nuances: Exposition narration & Description; effective business communication competence: Grammatical; Discourse competence: combination of expression & conclusion; Socio-linguistic competence: Strategic competence: Solution of communication problems with verbal and non-verbal means.

Module V
Kinesics: Definitions; importance; Features of Body Language; Voice Modulation: Quality,Pitch; Rhythm; intonation; Pronunciation; Articulation; stress & accent; Linguistic features of voice control: Vowel & Consonant Sounds.

LIST OF PRACTICALS TO BE CONDUCTED WITH THE RESPECTIVE MODULES.
Group Discussion: Practical based on Accurate and Current Grammatical Patterns.
Conversational Skills for Interviews under suitable Professional Communication Lab conditions with emphasis on Kinesics.
Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistics/Kinesics.
Presentation Skills for Technical Paper/Project Reports/ Professional Reports based on proper Stress and Intonation Mechanics. Official/Public Speaking based on suitable Rhythmic Patterns.

References:

1. Clifford Whilcomb & Leslie E, Effective inter-personal and team communication skills for engineers, Whilcomb Woley -IEEE press, 2013.
2. Johnson Eilola & Stuart, A Selber: Solving Problems in Technical Communication, University of Chicago Press, 2012.
3. Meenakshi Reman & Sangeetha Sharma: Technical Communication: Principles and Practice, Third Edition - Principles and Practice, OUP India,2015
4. Paul. J.Silvia, How to Write a Lot: A Practical Guide to Productive Academic Writing, American Psychological Association, 2007
5. Gustavii Bjorn,How to Write and Illustrate a Scientific Paper, Cambridge University Press
6. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
7. Practical Communication: Process and Practice by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2014, Delhi.
8. Modern Technical Writing by Sherman, Theodore A (et.al); Apprentice Hall; New Jersey; U.S.

24-215-0102 MATHEMATICS I

Course Description: Mathematics 1 subject gives the knowledge regarding trace standard curves in engineering practice and their properties and to learn about hyperbolic functions, series expansion of function and concept and application of partial differentiation.

24-215-0102	Mathematics I	Category	L	T	P	Credit	Year of Induction
		BSC	3	1	0	3	2024

Pre-requisites: Knowledge of trigonometric functions and trigonometric identities, Differentiation, Curve tracing.

Course objectives: This course introduces the concepts and applications of Partial differentiation, Hyperbolic functions and Standard curves in engineering practice. The objective of this course is to familiarize the prospective engineers with some advanced concepts and methods in Mathematics which include Differentiation of nth order, Taylor and Mac Lauren 's Series, Euler 's Theorem on homogeneous function, Error approximation which are invaluable for any engineer 's mathematical tool box. The topics treated in this course have applications in all branches of engineering

Course outcome: After the completion of the course the students will be able to

CO 1	Learn the properties of hyperbolic functions
CO 2	Compute Taylor and Mac Lauren Series of different functions and learning Leibnitz Rule of Differentiation
CO 3	Co-ordinate systems – Polar coordinates in plane, Cylindrical and Spherical polar coordinates in space. Familiarize with important curves in engineering practice
CO 4	Learn about curvature. Method of finding Envelopes and evolutes of curves
CO 5	Compute Partial Derivatives of functions of two variables and applications.

Mapping of course outcomes with PO: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	1				2	1					2
CO 2	3	1										
CO 3	2	2		2	1							2
CO 4	2	2	1	1	2							1
CO 5	3	2	2	1		2	2					1

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Exam
	1	2	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
200	100	100	3 hours

24-215-0102 MATHEMATICS I

Course Content:

Module I

Hyperbolic functions: Definitions, Relation between Hyperbolic and Circular functions Formulae for Hyperbolic functions, Inverses expressed as logarithms. Derivatives and Integrals of Hyperbolic functions, Series for Sinh x and Cosh x

Module II

Leibnitz ‘s rule for finding nth derivative, Standard forms, Taylor ‘s and Mac Lauren ‘s series

Module III

Introducing Polar coordinates, Cylindrical and Spherical polar coordinates. Standard curves in engineering practice such as conics, cycloids, hypocycloids, catenaries. Lemniscates, cardioids. Tangents & normals

Module IV

Envelopes, Curvature, Centre of Curvature, Radius of Curvature. Evolutes viewed both as locus of Centre of curvature and envelope of normal.

Module V

Partial derivatives. Euler ‘s theorem on homogeneous functions. Total derivative, Jacobians Errors and approximations, Maximum and Minimum of functions of two variables

References:

1. Kreyzig, E.; Advanced Engineering Mathematics, Wiley, New York, 2011.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna publishers, New Delhi, 201
3. John Bird, Higher Engineering Mathematics, Rowlledge, 2010.
4. Calculus and Analytical Geometry, George B.Thomas, Ross L. Finny (Pearsson, ninth Edition)
5. R.K.Jain, S.R.K Iyengar, Advanced engineering mathematics, Narosa, 2011

24-215-0103 ENGINEERING PHYSICS

Course Description: The aim of the Engineering Physics is to offer students a solid background in the fundamentals of Physics and to impart that knowledge in engineering disciplines. The program is designed to develop scientific attitudes and enable the students to correlate the concepts of Physics with the core programmes

24-215-0103	Engineering Physics	Category	L	T	P	Credit	Year of Induction
		BSC	3	1	-	3	2024

Pre-requisites: Higher Secondary Level physics and Mathematics at the plus two levels in schools.

Course Objectives: This is an introductory course, designed to provide the fundamental concepts of physics. To describe fundamental aspects of physics and its and applications to engineering field.

Course outcome: After the completion of the course the students will be able to

CO 1	Compute the quantitative aspects of waves and oscillations in engineering systems.
CO 2	Apply the knowledge of ultrasonics in non-destructive testing and use the principles of acoustics to explain the nature and characterization of acoustic design and to provide a safe and healthy environment.
CO 3	Apply the comprehended knowledge about laser and holography, Ultrasound waves into possible applications in engineering fields.
CO 4	Understand the concepts of fibre optic communication system
CO 5	Understand the behavior of matter in the atomic and subatomic level to perceive the microscopic processes in electronic devices i.e., dielectric and superconducting applications.

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	2										1
CO 2	2	2				1						1
CO 3	2	1				1						1
CO 4	2	1				1						1
CO 5	2	1				1						1

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Exam
	1	2	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
200	100	100	3 hours

24-215-0103 ENGINEERING PHYSICS
Course Content:

Module I
Oscillations and Waves: Harmonic oscillations, damped harmonic motion-Derivation of differential equation and its solution, over damped, critically damped and Under damped Cases, Quality Factor-Expression, Forced Oscillations-Differential Equation-Derivation of expressions for amplitude and phase of forced oscillations, Amplitude Resonance-Expression for Resonant frequency, Quality factor and Sharpness of Resonance, Electrical analogy of mechanical oscillators.
Wave motion- Derivation of one-dimensional wave equation and its solution, Three-dimensional wave equation and its solution (no derivation), Distinction between transverse and longitudinal waves, Transverse vibration in a stretched string, Statement of laws of vibration.

Module II
Acoustics & Ultrasonics: Acoustics, Classification of sound-Musical Sound-Noise, Characteristics of Musical Sounds-Pitch or frequency-Loudness or Intensity-Measurement of Intensity level-Decibel-Quality or timbre, Absorption coefficient, Reverberation-Reverberation time-Significance- Sabine's formula (no derivation), Factors affecting architectural acoustics and their remedies.
Ultrasonics-Production- Magnetostriction effect and Piezoelectric effect, Magnetostriction oscillator and Piezoelectric oscillator –Working, Detection of ultrasonic waves - Thermal and Piezoelectric methods, Ultrasonic diffractometer- Expression for the velocity of ultrasonic waves in a liquid, Applications of ultrasonic waves -SONAR, NDT and Medical.

Module III
Coherence and Lasers: Spatial and temporal coherence-coherence length-spontaneous emission-stimulated emission-population inversion- CW & pulsed Laser, typical laser systems like Helium-Neon, Nd, YAG, Ruby, Semi-conductor lasers. Applications of lasers, Principle of holography-reflection and transmission type, Recording and reconstruction, Applications of holography-white light holograms.
properties and application, Recording and reproduction of sound- Magnetic tape recording-sound recording on cine films

Module IV
Fibre optics and its applications: General ideas of optical fibre- NA of fibre-step index and graded index of fibres, multimode and single mode fibres, applications of optical fibres, fibre optic communication, optical fibre sensors, general ideas of integrated optics.

Module V
Crystallography and lattice planes: Crystallography-space lattice, unit cell-crystal systems-simple cubic-body centred and face centred cubes. Lattice planes and Miller indices, spacing between lattice planes, powder method for crystal study. Dielectrics: Types and applications. Superconductivity: Transition temperature, Meissner Effect-Isotope effect, Type I and type II-superconductors- B.C.S. theory (qualitative study), High temperature super conductivity (General idea), Josephson effect, SQUIDS.
Introduction to Quantum mechanics, wave nature of particles, Uncertainty principle, Introduction to nanoscience and technology, properties of nanomaterials, Applications of nanotechnology (Qualitative ideas).

References:

1. Theraja, Modern physics, S Chand, 2013.
2. Charles Kittel, Solid State Physics, Wiley, 2012.
3. D.K. Bhattacharya, Poonam Tandon, "Engineering Physics", Oxford University Press, 2015.
4. Ajoy Ghatak, Optics, McGraw Hill, 2012.
5. M.N.Avadhanulu, P.G.Kshirsagar,TVS Arun Murthy "A Text book of Engineering Physics", S.Chand &Co., Revised Edition, 2019.
6. Steve Cook, Interference, Double dare Publishers, 2014
7. Premlet B., "Advanced Engineering Physics", Phasor Books,10th edition ,2017.
8. Md.N.Khan & S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press,2016.
9. Bhavikatti, S.S. Solid State Physics, 7,PB 499, New age Publication,2019.
10. Sharma, S.S. Engineering Physics: Theory and Experiments, 3, PB 360 New age Publication, 2018.

24-215-0104 INTRODUCTION TO NAVAL ARCHITECTURE

Course Description: The objective of the course is to provide the learners with a broad appreciation of the science and art of Naval Architecture. Emphasis is given to define the subject in physical rather than mathematical terms. The learners would be able to have a clear understanding of the basic concept of a ship, underlying principles involved, definition of its geometry and various elements that constitute the ship as a whole, thus laying the foundation for more in depth studies in future.

24-215-0104	Introduction To Naval Architecture	Category	L	T	P	Credit	Year of Induction
		PCC	3	1	1	3	2024

Prerequisite: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Explain the basic terms, datums, dimensions, features and motions associated with ships and naval architecture
CO 2	Explain physical fundamentals of Naval Architecture, basic properties of ship and hull form, such as buoyancy, displacement and form co-efficients, and solve problems related to that
CO 3	Draw a faired Lines plan from an Offset table, and visualize the 3-D form of a ship from a Lines Plan
CO 4	Explain the evolution of ships - types of hull material, types of propulsion gear and power sources, types of ships, and types of hull forms.
CO 5	Explain the different Elements of a ship related to Structure, Spaces, Systems Equipment. Machinery, the Role of a Naval Architect in the Maritime Industry and the various organisations in the Maritime domain.

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2											
CO2	3	2	2	1	1							
CO3	3	3	2	1	3							
CO4	2	1	1									
CO5	2	2	1	1	1	3	3					3

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	Test 1	Test 2	
Remember	20	20	40
Understand	20	20	40
Apply	10	10	20
Analyze			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
200	100	100	3 hours

24-215-0104 INTRODUCTION TO NAVAL ARCHITECTURE
Course Content

Module I
Naval Architecture Terminology: Ship Terms – Centreline, Port, Starboard, Midships, Fwd, Aft, Inboard, Outboard, Bow, Beam, Quarter, Stern, Astern, Ahead, Knots, Nautical Mile, Port of Call, Port of Registry ; Datums-Reference Directions (Longitudinal, Transverse), Reference Planes (Buttock Plane, Waterplane, Section Plane), Reference Lines (Centreline, Baseline, Waterline(LWL), FP, AP, Midships), Dimensions (Moulded, Extreme, Length {L_{OA}, L_{BP}, L_{WL}}, Breadth, Depth, Draft, Freeboard), Draft Marks, Plimsoll Marks, Features (Camber, Sheer, Flare, Tumble home, Rise of Keel, Rise of Floor), Types of Motion (Translational { Surge, Sway, Heave}, Rotational (Roll, Pitch, Yaw}), Aspect (Heel, List, Trim)

Module II
Physical Fundamentals-Definition and Concept: Archimedes Principle, Law of Flotation, Volume, Buoyancy, CoB (LCB,VCB,TCB), Density, Weight, CoG(LCG,VCG,TCG), Displacement, Tonnage (GRT, NRT), Reserve of Buoyancy, Co-efficients of Form (C_B , C_M , C_W , C_P , C_{VP}), Stability (Stable, Unstable, Neutral), Shift of CoG (due to Removal, Addition and Shift of weight, Effect of suspended weight), TPC, LCF, MCT, Effect of density on draft and displacement(Box shaped and ship shaped vessels), Fresh Water Allowance, Maintaining draft when density changes. Practical: Numerical Problems

Module III
Lines Plan: Importance of Ship Geometry, 3D Geometry -Representing 3D objects in 2D views-Orthographic Projection-Orthogonal Planes, Lines Plan: Purpose, Three views -Body Plan, Half Breadth Plan, Sheer Plan or Profile, Three Curves - Stations, Waterlines, Buttocks, Types of Stem and Stern profiles, Offset Table, Drawing tools , Drawing of Border/ Grids and Labelling of Grids, How to Draw Body Plan using Offset Table, How to end stations using Keel Offsets, How to draw Half breadth Plan using Body Plan (using paper strip), How to end waterlines in Half Breadth Plan using Stem and Stern Offsets, How to draw Sheer Plan using Body Plan and Half Breadth Plan, How to draw diagonal, Fairing -Concept, importance and procedure, Title Box, Main Particulars box. Practical: Lines plan drawing (On Paper and any Drawing Software) from a given offset table and generation of final offset table after fairing.

Module IV
Evolution of Vessels : General – logs, canoe, rafts, boats, and ships; Types of Hull Material - wood, iron, steel, aluminium, GRP/FRP ; Types of Propulsion Gear and Power sources – Manual (Oars, poles), Wind (sails), Steam-Fossil fuels-Solar-Nuclear-Electric (paddle wheel, propeller) Types of Ships: Passenger(boats, ferry, ocean liner), Fishing Vessels (Trawlers, Seiners, Longliners, Factory Ship), Cargo Vessels (General Cargo, Tanker{Oil, Chemical, Gas}, Bulk Carrier(Ore, Grain, etc), Container, Reefer, RO-RO/Vehicle Carrier, Cattle Carrier, MPGC, SSDCetc.), Warships(Destroyer, Frigate, Aircraft Carrier, Submarine etc), Research/Scientific (Oceanographic, Hydrographic, Seismic, Polar etc.) Pleasure / Adventure (Speed boats, Yacht, Cruise ships etc.), Specialised Vessels (Dredger, Cable /Pipe laying, FPSO, Icebreaker,) Support Vessels (Tugs, AHTS, PSV, DSV, Crane Vessel, FF Vessel, Salvage Vessel etc.) Types of Hull Form: Displacement (Monohull, Multihulls {catamaran, SWATH, SWASH etc.}), Dynamic Lift (Planing Hulls{single/multiple chine}, Foil Lift{fully submerged, surface piercing), Air Lift{Air Cushion Vehicle, Wing in Ground Effect Crafts}), Combination Hull forms (Surface Effect Ships etc.)

Module V
Elements of Ships and Role of a Naval Architect : Ship Structure and Spaces : Hull- Shell, Deck (Inner Bottom/ Tank top, Main deck,), Bulkhead (Longitudinal, Transverse, Watertight, Non watertight), Single/Double Hull, Stiffeners (Longitudinals{Girders}, Transverses{Beams, Floors}); Superstructure (Bridge, Funnel, Mast etc.); Accommodation spaces (cabins, galley, wash spaces, messes, stores, Doors, Hatches, Porthole, Cargo hold, Engine Room, Tanks(Fuel,FW, LO, Ballast etc.), Underwater fittings (Rudder, Propeller, Stabiliser), Systems, Equipment and Machinery: Ventilation, Firefighting (Portable and Fixed), Anchoring Mooring and Towing, Life Saving, Cargo Handling, Propulsion and Auxillary Machinery, Power Generation and Distribution , Piping (Fuel, SW, FW, CW etc.), Insulation(Thermal{hot and cold), Acoustic), Cabling, Communication and Navigation (Lights etc), Role of a Naval Architect: Art or Science, Design- Stages of Design(Geometry, Stability, Resistance, Powering, Structure, GA, Seakeeping, Design Spiral), Construction (Time lines, Methods) , Maintenance (Frequency and types) ; -Origin and Purpose of Classification Societies, IMO, MMD and DG Shipping

Reference: -

1. Basic Ship Theory- K.J. Rawson and E.C. Tupper
2. Introduction to Naval Architecture- E.C. Tupper
3. Ship Stability for Masters and Mates- Capt D.R. Derret
4. Ship Stability: Notes and Examples – Kemp & Young
5. Naval Architecture for Marine Engineers - W. Muckle
6. Reed's Naval Architecture for Marine Engineers -EA Stokoe
7. Ships and Naval Architecture – R Munro Smith
8. Ship Design and Construction - SNAME Publication
9. Geometry for Naval Architects - Adrian Biran
10. Ship Hydrostatics and Stability – Adrian Biran
11. Principles of Naval Architecture-Vol 1 Stability and Strength, SNAME Publication
12. The Principles of Naval Architecture Series-The Geometry of Ships, SNAME Publication
13. Ship Construction- DJ Eyres
14. Introduction to Naval Architecture -Thomas C. Gillmer and Bruce Johnson

24-215-0105 ENGINEERING MECHANICS

Course Description: The goal of this course is to expose the students to the fundamental concepts of mechanics and enhances their problem-solving skills. It introduces students to the influence of applied force system and the geometrical properties of the rigid bodies while stationary or in motion. After this course students will be able to recognize similar problems in real-world situations and respond accordingly.

24-215-0105	Engineering Mechanics	Category	L	T	P	Credit	Year of Induction
		ESC	3	1	-	3	2024

Prerequisite: Nil

Course Objectives: This is an introductory course, designed to provide the fundamental concepts of Engineering Mechanics.

Course Outcomes: After completion of the course, the student will be able to:

CO1	Identify and describe the components of system of forces acting on a given system and determine the equilibrium of a particle using laws of mechanics.
CO2	Comprehend the principles of Coloumb friction and analyze systems that include frictional forces
CO3	Determine the moment of inertia of composite areas.
CO4	Understand the concept of motion of particles and rigid bodies.
CO5	Solve problems involving rigid bodies in general plane motion.

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2										1
CO2	3	3					1					1
CO3	3	3	2									1
CO4	3	3					1					1
CO5	3	3	2				1					1

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	Test1	Test2	
Remember	10	10	15
Understand	10	10	15
Apply	30	30	70
Analyze			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
200	100	100	3hours

24-215-0105 ENGINEERING MECHANICS

Course Content:

Module1

Introduction to Engineering Mechanics-statics-basic principles of statics-Parallelogram law, equilibrium law, principles of super position and transmissibility, law of action and reaction(review), free body diagrams.

Module 2

Friction–sliding friction-Coulomb 's laws of friction–analysis of single bodies–wedges, ladder analysis of connected bodies.

Parallel coplanar forces–couple – resultant of parallel forces– centre of parallel forces–equilibrium of parallel forces– Simple beam subject to concentrated vertical loads. General coplanar force system-resultant and equilibrium equations.

Module 3

Centroid of composite areas—moment of inertia-parallel axis and perpendicular axis theorems. Polar moment of inertia, radius of gyration, mass moment of inertia-ring, cylinder and disc.

Theorem of Pappus Guldinus (demonstration only), Forces in space-vectorial representation of forces, moments and couples–resultant and equilibrium equations–concurrent forces in space (simple problems only)

Module 4

Dynamics–rectilinear translation-equations of kinematics (review)Kinetics– equation of motion–D'Alembert's principle –motion on horizontal and inclined surfaces, motion of connected bodies. Impulse momentum equation and work energy equation (concepts only).

Curvilinear translation-equations of kinematics–projectile motion (review), kinetics–equation of motion. Moment of momentum and work energy equation (concepts only).

Module 5

Rotation–kinematics of rotation-equation of motion for rigid body rotating about a fixed axis– rotation under a constant moment. Plane motion of rigid body–instantaneous center of rotation (concept only). Simple harmonic motion–free vibration–degree of freedom undamped free vibration of spring mass system-effect of damping (concept only)

References:

1. Timoshenko and Young, Engineering Mechanics, McGraw Hill Publishers
2. Shames, I.H.,Engineering Mechanics-Statics and Dynamics, Prentice Hall of India.
3. C. Hibbeler and Ashok Gupta,Engineering Mechanics,Vol.I Statics, Vol.II Dynamics, Pearson Education.
4. Merriam J. L and Kraige L. G., Engineering Mechanics - Vols. 1 and 2, John Wiley.
5. Bhavikkatti, S.S., Engineering Mechanics, New Age International Publishers
6. Beer,F.P. &Johnston,E.R., "Vector Mechanics for Engineers-Statics and Dynamics", 11/e, McGraw Hill International Book Co., 2017
7. Rajasekaran S and Sankarasubramanian G, Engineering Mechanics-Statics and Dynamics, Vikas Publishing HousePvtLtd.
8. Arthur P. Boresi, Richard A. Schmidt, Engineering Mechanics Statics and Dynamics, Thomson Brooks/Cole Publications, 2004.

24-215-0106 PROGRAMMING IN ENGINEERING

Course Description: This course introduces students to the field of computer science and giving foundation to programming and basic concepts in software development. Beginning from the first principles of computer organization and history of computing, students will receive a foundation in programming through coding in a programming language. Fundamental programming concepts such as Data types, Operators, Flow control statements, Functions, Arrays and pointers will be covered through relevant programming assignments.

24-215-0106	Programming in Engineering	Category	L	T	P	Credit	Year of Induction
		ESC	2	1	2	3	2024

Pre-requisites: Nil

Course Objectives: This course provides problem solving and computer programming skills for students with no prior experience in the area of programming. Students will be using any one of the fundamental programming languages, to learn the fundamentals of computer programming including how to write, compile, execute programs especially for solving engineering problems.

Course Outcome: After the completion of the course the students will be able to

CO 1	Demonstrate the basic knowledge of computer hardware, software and algorithms
CO 2	Formulate computer programs for problem solving by adopting modular programming approach
CO 3	Write computer programs using conditional and iterative statements
CO 4	Analyse and select appropriate basic data structure and access methods for problem solving using programming language.
CO 5	Apply object-oriented programming for problem solving

Mapping of course outcomes with program outcomes: Level - Low (1) , medium(2) and high(3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3											
CO 2	1	3	2	1								
CO 3	2	3	2	2	1							
CO 4	2	3	2	1	1							
CO 5	2	3	2	1	1							1

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Exam
	1	2	
Remember	10	10	20
Understand	15	15	30
Apply	25	25	50
Analyse			
Evaluate			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
200	100	100	3 hours

24-215-0106 PROGRAMMING IN ENGINEERING
Course Content:

Module I

History of Computing, Generations of Computers, Basic computer organization, representation of information, memory allocation, storage devices, software, operating system, Algorithm, Pseudo code and Flow chart, compilation, debugging, executable code

Module II

Identifiers, Data Types, Variables, Constants, Input / Output, Operators, Expressions, Precedence and Associatively, Expression Evaluation, Type conversions, Declarations, Initializations, preprocessor commands.

Module III

Control flow Statements- Decision making, branching, looping, Simple Programming examples.

Introduction to Structured Programming – Functions, user defined functions, parameter passing, Storage classes, scope rules, recursive functions.

Module IV

Arrays, structures and unions, Pointers - Pointer Applications, Arrays and Pointers, Pointer Arithmetic, memory allocation functions, array of pointers, self-referential structures, linked lists.

Module V

Strings, File handling, Introduction to Object Oriented Programming, Classes and objects, Advanced programming languages

References:

1. Computer Science: A Structured Programming Approach Using C, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Programming in C. P. Dey and M Ghosh , Oxford University Press.
3. Stephen G.Kochan, Programming in Objective- C, Adison Wiley, 2013.
4. Anita Goel, Computer Fundamentals, Pearson, 2010
5. ReemaTareja: Introduction to C programming, Oxford University Press, 2015.
6. Rama N. Reddy and Carol Ziegler, C Programming for Scientists and Engineers with applications, Jones & Bartlett learning, 2009.
7. Kernighan, B.W.K. &Ritchi, D.M.; The C Programming Language (Ansi C Version), Prentice Hall of India, 1990.
8. Richard Johnson-Baugh & Martin Kalin, Applications Programming in Ansi C; Macmillan International Edition, 1996
9. Schildt, H.; C Made Easy; McGraw Hill Book Company, 1985.
10. D S Yadav, Programing for problem solving using C, 1,PB,425,2020,New Age Punlication.
11. Programming with C, B.Gottfried, 3rd edition, Schaum's outlines, TMH.
12. Object-Oriented Programming in C++, Robert Lafor
13. Problem Solving and Programming in C , Y. Daniel Liang

24-215-0107 WORKSHOP PRACTICE I

Course Description: This training mainly focuses on to develop a platform where the students can enhance their engineering knowledge in the practical working environment by applying the theoretical knowledge they acquired.

24-215-0107	Workshop Practice I	Category	L	T	P	Credit	Year of Induction
		ESC	0	0	4	2	2024

Prerequisite: Nil

Course Objectives: The objective of this lab is to provide practical experience on various basic mechanical workshop operations.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Machine the given specimen to required dimension.
CO 2	Demonstrate the principle of mechanical process and operations.
CO 3	Describe specific operations carried out.
CO 4	Apply the theoretical knowledge gained in the class room with the physical world.
CO 5	Carry out scientific experiments as well as accurately record and analyse the results of such experiments.
CO 6	Function as a member of a team, communicate effectively and engage in further learning and problem solving.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2		1									
CO 2	3											
CO 3	2											1
CO 4	3	2										1
CO 5	2	1								1		1
CO 6	1								1	1		1

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	5	5	
Understand	10	10	
Apply	10	10	
Analyse			
Evaluate			

Mark distribution Continuous Assessment : Class work 50% Marks Internal Tests: 50% Marks

Total Marks	CIE	ESE	ESE Duration
50	50	-	3 hours

List of Experiments

1. Fitting Shop
2. Carpentry Shop
3. Sheet Metal Shop
4. Lathe
5. Shaping m/c, Planning m/c, milling m/c, Drilling and Boring m/c

SEMESTER II

24-215-0201 MATHEMATICS II

Course Description: This course equips students with concepts of Fourier Series, Vector Calculus and convergence and divergence of series which has many applications in Engineering and to understand basic theory of Ordinary Differential Equations and Multiple integrals

24-215-0201	Mathematics II	Category	L	T	P	Credit	Year of Induction
		BSC	3	1	0	3	2024

Pre-requisites: Calculus of single and multi-variable calculus

Course objectives: This course introduces the concepts and applications of Integral calculus. The objective of this course is to familiarize concepts of Fourier series, Different Kinds of co-ordinate systems and behaviour of series which are invaluable for any engineer ‘s mathematical tool box. The topics treated in this course have applications in all branches of engineering.

Course outcome: After the completion of the course the students will be able to

CO 1	Evaluate surface and volume integrals and learn their inter-relations and applications
CO 2	Learn concept of Curl, Divergence and Gradient and its applications
CO 3	Solve homogeneous and non-homogeneous linear differential equation with constant coefficients
CO 4	Fourier series, Introduction, Euler’s formulae, Expansion of functions
CO 5	Make a study on important tests of convergence of infinite series

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	1				1						2
CO 2	2	1										
CO 3	2	2		2	2							
CO 4	3	1	1	1	2							1
CO 5	2	1	1	2		2	1					1

Assessment Pattern:

Bloom ‘s Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
200	100	100	3 hours

24-215-0201 MATHEMATICS II
Course Content:

Module I

Applied Integral Calculus. Areas, arc-lengths, volumes and surface areas of solids of revolution. Multiple Integrals; Jacobians.

Module II

Vector calculus, Expression for Gradient, divergence, curl in different coordinate systems systems. Gauss thermoscope's theorem. (Proof is not required)

Module III

Ordinary Differential Equations of the second order with constant coefficients, Euler-Cauchy type. Simultaneous Linear Equations.

Module IV

Fourier series. Even and Odd functions Full range and half-range series.

Module V

Sequences and infinite series: Convergence and divergence. Radius of convergence, comparison tests, Raabe's test. Solution of first order and second order differential equations at regular points (Singular points not included)

References:

1. Kreyzig, E.; Advanced Engineering Mathematics, Wiley, New York, 2011.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna publishers, New Delhi, 2011.
3. 3. Calculus and Coordinate Geometry George B. Thomas, Ross L Finny (Pearson Ninth Edition)
4. John Bird, Higher Engineering Mathematics, Rowlledge, 2010.
5. R.K.jain, S.R.K Iyengar, Advanced engineering mathematics, Narosa, 2012

24-215-0202 BASIC SHIP THEORY

Course Description: The course is an introduction to the basic mathematical concepts like Numerical Integration and its application to a Lines Plan to obtain Bonjean and Hydrostatic parameters. The course will provide the learners with an introduction to basic naval architecture concepts and exposure to numerical problems, which will form a foundation for understanding of complex subjects like stability, resistance , powering, sea keeping etc.

24-215-0202	Basic Ship Theory	Category	L	T	P	Credit	Year of Induction
		PCC	3	1	1	3	2024

Pre-requisites: Nil

Course Outcomes: After the completion of the course the student will be able to

CO 1	Explain the concept of Numerical Integration
CO 2	Apply Numerical Integration techniques to obtain parameters related to hull geometry
CO 3	Calculate Bonjeans Areas and Moment values and draw the curves and Hydrostatic Curves from a given Lines Plan.
CO 4	Calculate Hydrostatics values and draw the curves from a given Lines Plan and Explain the concept of each Hydrostatic parameter of a ship.
CO 5	Solve numerical problems to estimate change in drafts due to list, trim and parallel sinkage / rise.

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	2		2							3
CO 2	3	2	1		2							3
CO 3	3	2	1									3
CO 4	3	2	3									2
CO 5	3	2	3		1							2

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	10	10	20
Apply	30	30	60
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0202 BASIC SHIP THEORY

Course Content:

Module I

Numerical Integration Introduction-Analytical Integration vs Numerical Integration, Need for Numerical Integration for estimating ship form parameters; Integration Rules-Trapezoidal rule, Simpson 's rules (1-4-1, 1-3-3-1 and 5, 8,-1 rules), 6 ordinate rule, Tchebycheff's rule, Modification for Subdivided Intervals, 3,10,-1 Rule; 7,36,-3 Rule;

Practical: Numerical Problems

Module II

Application of Numerical Integration Application to ship geometry to find parameters (Cross sectional areas- Water plane area, Transverse section area; First Moment of areas about transverse axis (M_y) and about centreline (M_x) ; Centroids of Area and Volume, LCF, LCB, VCB; Second Moment of Areas about transverse axis(I_L, I_F) and about centreline(I_T))

Module III

Bonjeans Purpose and Concept; Calculation of Bonjean Areas and Moments using numerical integration -Procedure for Drawing of Bonjean Area and Moment curves; How to calculate volume for an inclined waterplane using Bonjeans curves; Sectional area curve – Significance, Parameters obtained from it.

Practical: -Bonjeans Calculation (by hand / Excel) and Drawing.

Module IV

Hydrostatics : Purpose and Concept; Concept of Metacentre, Introduction of transverse and longitudinal Stability-Parameters (GM, GZ); Shift of CoB due to external force; Shift of CoG due to internal weight shift; Definition of Hydrostatic Parameters - Volume, Displacement, KB, BM_T, BM_L, KM_T, KM_L, TPC, MCT, LCF, LCB, Form Co-efficients (C_B, C_M, C_P, $C_{VP,}$ C_W), Wetted Surface Area; Derivation of formula for BM, TPC, MCT and GZ; Calculation of Hydrostatic Parameters; Procedure for drawing Hydrostatic Curves; Features of Hydrostatic Curves

Practical: -Hydrostatics Calculation (by hand / Excel) and Drawing, Calculation in Ship Design Software

Module V

Estimating Change in Draft Calculating Parallel Sinkage/Rise, Trim and List due to addition, removal and shift of weight and change of density; Ship Squat, Using Trim to find CoF, loading weight to keep aft draft constant, Loading weight to produce required draft, Using Change of Trim to find $GM_{L,}$ Increase in Draft due to list (Box Shaped Vessels and Vessels with rise of floor), Combined List and Trim

Reference: -

1. Basic Ship Theory- K.J. Rawson and E.C. Tupper
2. Introduction to Naval Architecture- E.C. Tupper
3. Ship Stability for Masters and Mates- Capt D.R. Derret
4. Ship Stability: Notes and Examples – Kemp & Young
5. Naval Architecture for Marine Engineers - W. Muckle
6. Reed's Naval Architecture for Marine Engineers -EA Stokoe
7. Ships and Naval Architecture – R Munro Smith
8. Geometry for Naval Architects - Adrian Biran
9. Ship Hydrostatics and Stability – Adrian Biran
10. Principles of Naval Architecture-Vol 1 Stability and Strength, SNAME Publication
11. The Principles of Naval Architecture Series-The Geometry of Ships, SNAME Publication
12. Introduction to Naval Architecture -Thomas C. Gillmer and Bruce Johnson

24-215-0203 ELECTRICAL ENGINEERING

Course Description: This course on Electrical Engineering aims to equip learners with a comprehensive understanding of electromagnetism, circuit analysis, machines and electronic communication, preparing them for further study and practical applications in the field of electrical engineering. The aim of the course is to lay a solid base to electrical technology in view of understanding the electrical systems in ship and shipyard. The subject pitches gradually from the basic concepts of electromagnetism and analysis of ac circuits to principles of various electrical machines.

24-215-0203	Electrical Engineering	Category	L	T	P	Credit	Year of Induction
		ESC	3	1	-	3	2024

Pre-requisites: Nil

Course Objectives: The objectives of this course are i) To provide the learners a proper understanding of electromagnetism and circuit analysis as a base to study various electrical systems and equipment. ii)To impart understanding of the construction, characteristics and applications of DC and AC machines. iii) To introduce the basics of electronic communication, including modulation, transmission and reception of signals

Course outcome: After the completion of the course the students will be able to

CO 1	Discern the principles of electromagnetism and explore the laws governing electromagnetic induction and the behavior of magnetic and electric fields.
CO 2	Analyze the behavior of single phase and three phase ac circuits and explore voltage, current, power relationships, and impedance in both the systems.
CO 3	Analyze constructional details, principle of operation, testing and applications of dc generators and motors
CO 4	Analyze constructional details, principle of operation testing and applications of transformers.
CO 5	Learn the basic analog communications system, waveforms, modulation index and features of Amplitude modulation and Frequency modulation

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2										
CO 2	3	2									1	
CO 3	3	2									1	
CO 4	3	2	1	1							1	
CO 5	3	2	1			1						

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	5	20
Understand	10	10	40
Apply	5	10	40
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0203 ELECTRICAL ENGINEERING

Course Content:

Module I

Magnetic Circuits- MMF, Magnetic Flux, Reluctance, Inductance - Inductances in Series and Parallel, Mutual Flux and Leakage Flux, Coefficient of Coupling, Dot Convention, Electromagnetic Induction: Faraday's laws of Electromagnetic induction, Induced E.M.F., Capacitance – Electrostatics, Capacitance, Parallel Plate Capacitor, Capacitors in series and parallel, Energy stored in Electrostatic Field

Single-phase AC Circuits - Average Value, Effective Value, Form and Peak factors for square, triangle and sinusoidal waveforms. Polyphase AC circuits: Generation of polyphase voltage-phase difference--comparison between single phase and three phase systems-star and delta connection-current, voltage and power in three phase systems-balanced and unbalanced three phase circuits-power measurements in three phase circuits using single wattmeter and three wattmeter methods. Introduction to power management systems.

Module II

DC Machines- D.C. generators-construction details-principle of operation-emf equation-methods of excitation characteristics- applications. D.C. motors-principle of operation-back e.m.f.-speed and torque equations-characteristics-losses-efficiency-applications of shunt, series and compound wound motors.

Module III

Transformers: principle and theory of an ideal transformer-Constructional features of single-phase transformer-core type-shell-type-emf equation-turns ratio-no load vector diagram-transformer on load-equivalent circuit-impedance transformation-transformer losses-, efficiency-open circuit and short circuit tests-estimation of equivalent circuit parameters. Auto transformer –working principle -basics of current transformer, potential transformer and three phase transformers.

Module IV

Rotating AC Machines: Alternators-construction details-principle of operation-types-emf equation(winding factor need not be derived)-synchronous speed-Synchronous motors- principle of operation and method of starting- Three Phase Induction Motor: Working principle, construction, types; slip, performance characteristics and efficiency, Single Phase Induction Motor -working, Types-split phase and capacitor start.

Module V

Basics of Electronic communication: Basic model of a communication system: transmitter, receiver and channel. Need for modulation and types - classification of communication based on modulation. Basic analog communications system -Amplitude modulation, Frequency modulation –modulation index, features of AM and FM—Super heterodyne receiver for AM and FM. Introduction to satellite communication systems in ships.

References:

1. Fundamentals of Electrical Engineering, Ashfaq Husain &Harroon Ashfaq, Fourth edition, 2016, Dhanpai Rai & Co
2. Basic Electrical Engineering, J.B Gupta, 2013 Published by S.K. Kataria& Sons
3. J. A. Edminister, Electric Circuit Theory, Schaum's Outline series: 6th ed., McGraw Hill, 2014
    A. Desoer and E. S. Kuh, Basic Circuit Theory, McGraw Hill, 2009
4. Fitzgerald and Kingsley's Electric Machinery by Stephen Umans, seventh edition, 2013
5. Electrical Machinary – P S Bimbra, Khanna Publishing, 2021
6. Reed 's Vol.6: Basic Electro technology for Engineers- Chirstopher Lavers, Edmund G.R. Kraal & Stanley Buyers, Ed.4, 2013
7. Kennedy 's Electronic Communication Systems – George Kennedy, Bernard Davis McGraw-Hill, 5th ed., 2011

24-215-0204 MECHANICS OF SOLIDS

Course Description: This course on Mechanics of Solids throws light on the behaviour of different types of solids made of different materials and having different cross-sections under various loading conditions. The various principles and numerical calculations developed in structural designs are applied here. The subject pitches gradually from the basic concepts of stress and strain to problems on thin-walled pressure vessels and columns.

24-215-0204	Mechanics of Solids	Category	L	T	P	Credit	Year of Induction
		ESC	3	1	-	3	2024

Prerequisite: Knowledge in basic engineering courses like engineering mathematics and engineering mechanics.

Course Objectives: This is an introductory course, designed to provide the fundamental concepts of behaviour of different types of solids under various loading conditions.
Course outcome: After the completion of the course the students will be able to

CO 1	Assimilate the concepts on stress, strain, modulus of elasticity and the relationship between different elastic constants.
CO 2	Able to draw the bending moment diagram and shear force diagram for various types of beams under different boundary conditions and loading.
CO 3	Understand the theory of pure bending of beams, section modulus, bending stresses, moment of resistance and calculate the shear stress distribution in various cross sections.
CO 4	Determine principal stresses and maximum shear stress with the aid of equations and Mohr‘s circle.
CO 5	Conceive the concept on torsion and its applications.
CO 6	Solve problems related to buckling of columns and critical buckling.

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	1									1
CO 2	3	3										
CO 3	3	2										1
CO 4	3	3										
CO 5	3	2					1					
CO 6	3	2	2				1					

Assessment Pattern:

Bloom ‘s Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0204 MECHANICS OF SOLIDS
Course Content:

Module I

Basics in Mechanics of Solids: Types of Loads and Uni-axial, Biaxial stresses and; Tri-axial State of Stresses.

Stress-Strain Concepts: Tension, Compression and Shear; Uni-axial stresses; Elastic Limit; Stress-Strain relationship for mild steel; Hooke's Law; Yield point; Bars of varying sections; Bars of composite sections; Temperature Stresses; Poisson's Ratio; Stress-Strain Diagram; Working Stress; Factor of safety; Volumetric strain; Modulus of elasticity; Modulus of rigidity; Bulk Modulus- Relationship between the elastic constants.

Module II

Bending Moment and Shear Force: Definitions and introduction to different types of supports; Concept of shear force and bending moment; Beams and Loads; Sign conventions; Shear force and Bending Moment Diagrams for Cantilever, simply supported and Overhanging beams with various types of loading (Point load, Distributed load, Couples).

Module III

Stresses in Beams: Simple bending; Theory of Simple Bending; Assumptions in Simple Bending; Neutral axis; Section Modulus; Flexural rigidity; Stresses in symmetrical sections; Bending Stress Distribution.

Shear Stress: Shear stress distribution in beams; Assumptions; Shear stress distribution for rectangular, circular, triangular, I and T sections.

Module IV

Principal Stresses and Strains: Introduction; Principal Stresses and Principal Strain; Mohr's Circle; Representation of Stress in 2D problems.

Beam Deflection: Differential Equation of the Elastic curve; Slope and deflection of beams by method of successive integration; Moment Area Theorem.

Columns and Struts: Euler's Theory; Rankine's Formula

Module V

Thin-Walled Pressure Vessels: Introduction; Biaxial Tension and Compression in Thin-Walled Pressure Vessels such as cylindrical and spherical.

Torsion: Introduction to torsion; Theory of pure torsion; Torsion of Circular Shafts; Shear stresses; Shear deformation.

References:

1. S. Timoshenko; Strength Of Materials; CBS Publishers and Distributors Pvt. Ltd., 3rd edition 2021.
2. R C Hibbeler; Mechanics of Materials; Pearson Education, 10th edition, 2022
3. Popov; Mechanics of Materials; Pearson Education, 2nd edition, 2015
4. Ferdinand P. Beer, E. Russell Johnston; Mechanics of Materials; Mc Graw Hill, 8th edition, 2020
5. Bansal R. K; Strength of Materials; Lakshmi Publications; New Delhi, 4th edition, 2007
6. Timoshenko S. P.; Strength of Materials Part 1; 3rd edition, D. Van Nostrand Company Inc .New York, 2002
7. S. Ramamrutham ; Strength of Materials; Dhanpat Rai Publishing Company, 16th edition,2008.
8. S. S Bavikatti; Strength of Materials; Vikas Publishing House Pvt Ltd., 4th edition, 2014.
9. Shames I. H., James M. Pitarresi; Introduction to Solid Mechanics; Pearson Education India. 3rd edition, 2015
10. V.N. Vazirani, M.M.Ratwani, analysis of structures . Vol 1, Khanna Publishers, 2015
11. T. D. Gunneswara Rao, Mudimby Andal; Strength of Materials: Fundamentals and Applications; Cambridge University Press; 1st edition, 2018
12. Punmia B. C. and A. K. Jain, Mechanics of Materials, Laxmi Publications (P) Ltd, 2017

24-215-0205 ENGINEERING GRAPHICS

Course Description: To enable the students to effectively perform technical communication through graphical representation as per global standards.

24-215-0205	Engineering Graphics	Category	L	T	P	Credit	Year of Induction
		ESC	2	2	1	3	2024

Prerequisite: Nil

Course Objectives: This is an introductory course, designed to provide the fundamental concepts of Engineering Graphics.

Course outcome: After the completion of the course the students will be able to

CO 1	Draw the projection of points and lines located in different quadrants
CO 2	Prepare Multiview orthographic projections of objects by visualizing them in different positions
CO 3	Draw sectional views and develop surfaces of a given object
CO 4	Prepare pictorial drawings using the principles of isometric and perspective projections to visualize objects in three-dimensions
CO 5	Convert 3D views to orthographic views and vice versa
CO 6	Obtain multi-view projections and solid models of objects using CAD tools

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3											
CO 2	3									1		
CO 3	3	1								1		
CO 4	3									1		
CO 5	3	1	1		2					2		
CO 6	3	1	1		3					3		

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	20	20	40
Apply	20	20	40
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0205 ENGINEERING GRAPHICS
Course Content:

General Instructions:
First angle projection to be followed
Section A practice problems to be performed on A4size sheets
Section B classes to be conducted on CAD lab

SECTION -A

Module I

Introduction: Relevance of technical drawing in engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing. **Orthographic projection of Points and Lines**: Projection of points in different quadrants, Projection of straight lines inclined to one plane and inclined to both planes. Trace of line. Inclination of lines with reference planes True length of line inclined to both the reference planes.

Module II

Orthographic projection of Solids: Projection of Simple solids such as Triangular, Rectangle, Square, Pentagonal and Hexagonal Prisms, Pyramids, Cone and Cylinder. Projection of solids in simple position including profile view. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes.

Module III

Sections of Solids: Sections of Prisms, Pyramids, Cone, Cylinder with axis in vertical position and cut by different section planes. True shape of the sections. Also locating the section plane when the true shape of the section is given. **Development of Surfaces**: Development of surfaces of the above solids and solids cut by different section planes. Also finding the shortest distance between two points on the surface.

Module IV

Isometric Projection: Isometric View and Projections of Prisms, Pyramids, Cone, Cylinder, Frustum of Pyramid, Frustum of Cone, Sphere, Hemisphere and their combinations.

Module V

Perspective Projection: Perspective projection of Prisms and Pyramids with axis perpendicular to the ground plane, axis perpendicular to picture plane. Conversion of Pictorial Views: Conversion of pictorial views into orthographic views and vice versa

SECTION -B (To be conducted in CAD Lab)

Introduction to Computer Aided Drawing: Role of CAD in design and development of new products, Advantages of CAD. Creating two-dimensional drawing with dimensions using suitable software. Conversion of pictorial views into orthographic views. (Minimum 2 exercises mandatory). Introduction to Solid Modelling: Creating 3D models of various components using suitable modelling software. (Minimum 2 exercises mandatory)

References

1. Bhatt, N.D.,Engineering Drawing, Charotar Publishing HousePvt.Ltd.
2. John, K.C.Engineering Graphics, Prentice Hall India Publishers
3. Venugopal, K. Engineering Graphics (As Per Anna University),15,PB,475, New age Publication,2018,
4. Agrawal,B.and Agrawal,C.M., Engineering Drawing, TataMcGrawHill Publishers. 2.Duff,J.M.and Ross,W.A., Engineering Design and Visualisation, Cengage Learning
5. Kulkarni, D.M.,Rastogi,A.P.and Sarkar,A.K.,Engineering Graphics with AutoCAD, PHI
6. .Luzaddff,W.J. and Duff,J.M.,Fundamentals of Engineering Drawing, PHI.

24-215-0206 ENGINEERING CHEMISTRY

Course Description: To enable the students to acquire knowledge in the concepts of chemistry for engineering applications and to familiarize the students with different application-oriented topics like, Engineering materials, electrochemistry, Fuels, lubricants, pollution etc. Also familiarize the students with topics like mechanism of corrosion, corrosion prevention methods, polymers, desalination etc., which enable them to develop abilities and skills that are relevant to the study and practice of chemistry.

24-215-0206	Engineering Chemistry	Category	L	T	P	Credit	Year of Induction
		BSC	3	1	-	3	2024

Pre-requisites: Concepts of chemistry introduced at the plus two levels in schools.

Course Objectives: This is an introductory course, designed to provide the fundamental concepts of chemistry. To describe fundamental aspects of chemistry and its and applications to engineering field

Course outcome: After the completion of the course the students will be able to

CO 1	Recognize/recall the various types of materials with their application.
CO 2	Understand the basic concepts of electrochemistry and corrosion to explore its possible applications in engineering fields.
CO 3	Identify chemical characteristics of fuels.
CO 4	Apply the information learned to differentiate the lubricants
CO 5	Analyze various types of water treatment methods to develop skills for treating wastewater.

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	1	2					1					2
CO 2	2	1										
CO 3	3	1										
CO 4	2	1										1
CO 5	1	1					3					1

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0206 ENGINEERING CHEMISTRY
Course Content:

Module I

Production of engineering materials – Production of steel – Bessemer converter process, open hearth process, electric furnaces, oxygen process, chemical additions to steels. Production of non-ferrous alloys – Production of aluminium and its alloys, Production of other non-ferrous alloys – bronze, brass, and special reference to the requirements of shipbuilding (ships propellers etc). Plastics - formation of high polymers, thermoplastic and thermosetting resins, methods of fabrication of plastics, production of GRP-materials.

Module II

Electrochemistry – classification of conductors, electrolytes, conductance of electrolytes, specific and equivalent conductance, application of conductance measurements, Debye Huckel model of electrolytic conductance and Onsager equation. Galvanic cells, EMF measurements, classification of electrodes, Nernst equation, electrode potentials, cell reactions. Relationship between cell potential and thermodynamic quantities. Electrochemical energy sources, lead acid battery, nickel cadmium battery. Fuel cells (H2/O2). Electrochemical corrosion and its application.

Module III

Fuels and Combustion – Solid, liquid and gaseous fuels, calorific value of fuels, properties and adverse effects, calorific intensity, flue gas analysis. Coal – analysis of coal, carbonisation of coal, metallurgical coke and its manufacture, hydrogenation of coal. Petroleum – Origin and refining of petroleum, cracking and polymerisation, requisites of good petrol. Diesel oil, Petrochemicals, Gaseous fuels – natural gas, LNG, Hydrogen, Ammonia, Methanol, LPG, Producer gas, combustion zone, reduction zone, water gas, coal gas, oil gas. Combustion calculations, explosives. Propellants, Nuclear fuels – nuclear fission and fusion. Types of lithium batteries used in marine field.

Module IV

Lubricants – Mechanisms of lubrication, boundary lubrication, extreme pressure lubrication. Classification of lubricants: synthetic lubricants & properties of lubricant.

Module V

Water and its Treatment – Source of water, hard and soft water, determination of hardness, softening water– lime soda process, ion exchange. Boiler feed water – removal of oil, blow down operation, caustic embrittlement, internal conditioning. Water for domestic purposes – sedimentation, coagulation, filtration and sterilisation, chlorination and its advantages and disadvantages. Disinfection with Ozone. Desalination. Pollution – chemical characteristics, sewage treatment – biological oxygen demand (BOD), chemical oxygen demand (COD), total organic carbon (TOC). Solid wastes, Water pollution, Air pollution, their control.

References:

1. Balasubramanian M.R., Krishnamoorthy S. & Murugesan V., Engineering Chemistry, Allied Publishers Ltd., 2011.
2. Soney C. George,RinoLaly Jose, “Text Book of Engineering Chemistry”, S. Chand & Company Pvt Ltd, 2019.
3. M.N. Maulik, Water Supply, Waste Water Treatment & Sewage Disposal, Standard Book House, 2011.
4. Raman Sivakumar, R.Jayaprakasham, N.Sivakumar, Engineering Chemistry, McGraw Hill Education India, 2011
5. MuhammedArif, Annette Fernandez, Kavitha P. Nair “Engineering Chemistry”, Owl Books,2019
6. S.P.Srivastava, Advances in Lubricant Additives and Tribology, CRC press, 2009.
7. K.S.Venkateswarlu, Water Chemistry-Industrial and power station water treatment, New Age Publishers, 2005.
8. O.G. Palanna, Engineering Chemistry, Tata McGraw Hill, 2017.
9. S.L. Kakani,Engineering Materials, 1,pb 299 New age Publication,2020.
10. Telang, Tulika Engineering Chemistry, 2, PB 325 2018, ew age Publication,2020

24-215-0207 WORKSHOP PRACTICE II

Course Description: This training mainly focuses on to develop a platform where the students can enhance their engineering knowledge in the practical working environment by applying the theoretical knowledge they acquired. This lab provides practical experience on various welding equipment.

24-215-0207	Workshop Practice II	Category	L	T	P	Credit	Year of Induction
		ESC	-	-	4	2	2024

Prerequisite: Nil

Course outcome: After the completion of the course the students will be able to

CO 1	Describe welding operation carried out.
CO 2	Demonstrate the principle of operation of MMAW, TIG and MIG
CO 3	Prepare specified type of joint using various welding processes.
CO 4	Apply the theoretical knowledge gained in the class room with the physical world.
CO 5	Carry out scientific experiments as well as accurately record and analyse the results of such experiments.
CO 6	Function as a member of a team, communicate effectively and engage in further learning and problem solving.

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2		1									
CO 2	3											
CO 3	2											1
CO 4	3	2										1
CO 5	2	1								1		1
CO 6	1								1	1		1

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	5	5	-
Understand	10	10	-
Apply	10	10	-
Analyse			
Evaluate			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
50	50	-	

Continuous Assessment : Class work 50% Marks Internal Tests: 50% Marks

List of Experiments

1. Introduction to Welding Technology (Theory) – Historical review, classification of welding process, Gas welding, Manual metal arc welding, Submerged arc welding, Electro slag welding, Inert gas welding, Plasma arc welding, **Resistance welding and Gas cutting.**
2. Welding Practice – Arc welding, Gas welding, Gas cutting. **TIG, MIG and Spot welding**

SEMESTER III

24-215-0301 MATHEMATICS III

Course Description: This course equips students with concepts of Eigen values and diagonalization of matrix which has many applications on Engineering and to learn basic theory of functions complex variable and conformal transformation

24-215-0301	Mathematics III	Category	L	T	P	Credit	Year of Induction
		BSC	3	1	0	3	2024

Pre-requisites: Knowledge of matrices, determinants, complex variable, statistics Course objectives: This course introduces the concepts and applications of diagonalization of matrices, Eigen values, Laplace transform and important distributions in statistics and moment generating functions. The objective of this course is to familiarize concepts of functions complex variable and conformal transformation and solution of Partial Differential Equations which are invaluable for any engineer‘s mathematical tool box. The topics treated in this course have applications in all branches of engineering.

Course outcome: After the completion of the course the students will be able to

CO 1	Compute Eigen values of matrix and diagonalise
CO 2	Determine Laplace transforms of important functions
CO 3	Identify Analytic function, Harmonic function and Conformal Mapping
CO 4	Familiarize with moments, moment generating function and important statistical distributions
CO 5	Solve Partial Differential Equations

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	1				1	1					1
CO 2	1	1										
CO 3	2	2		2	1							
CO 4	2	1	1	1	2							2
CO 5	1	2	2	2		2	1					1

Assessment Pattern:

Bloom ‘s Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0301 MATHEMATICS III

Course Content:

Module I

Eigen values and Eigen vectors of a square matrix. Diagonalisation. Finding the nth power of a square matrix, Orthogonal, Hermitian and Skew Hermitian matrices. Theorems on the eigenvalues of these. Cayley Hamilton theorem

Module II

Laplace Transforms. Unit step function- Dirac Delta functions. Periodic functions. Inverse transforms. Convolution theorem. Solution of Ordinary Differential Equation, using Laplace transforms

Module III

Analytic functions of a complex variable. Cauchy-Riemann equations, Harmonic functions. Application to fiow problems Euler‘s formula and its uses in summation of series (C+i S method)

Module IV

Expectation, Variance and n th moments of the Binomial, Geometric, Poisson, Exponential and Normal variates. Moment generating functions

Module V

Partial Differential Equations of the form F (x, y, z, p, q) = 0. Formation Complete, Singular and General Integrals. Linear equation of first order- LaGrange’s equation, Non-linear equations of first order. Charpit‘s Method

References:

1. Kreyzig, E.; Advanced Engineering Mathematics, Wiley, New York, 2011
2. B.S.Grewal, Higher Engineering Mathematics, Khanna publishers, New Delhi, 2011
3. William E. Boycee, Richard C. Diprima, Elementary differential equations and Boundary value problems. WILEY-INDIA EDITION Ninth edition
4. John Bird, Higher Engineering Mathematics,Rowlledge, 20
5. R.K.jain, S.R.K Iyengar, Advanced engineering mathematics, Narosa, 2012
6. N.W.McLachlan, Laplace transforms and their applications to differential equations, Dover publications, 2014

24-215-0302 FLUID MECHANICS I

Course Description: This course covers the fundamentals of fluid mechanics: the properties and behaviour of fluid, hydrostatics, buoyancy, rigid body accelerations, inviscid flow, applications of Bernoulli's theorems, control volume analysis for more complex fluid flow problems, dynamical similarity and dimensional analysis.

24-215-0302	Fluid Mechanics I	Category	L	T	P	Credit	Year of Induction
		ESC	3	1	-	3	2024

Pre-requisites: Knowledge in basic engineering courses like engineering physics, engineering mathematics: calculus and differential equations, elementary vector and tensor algebra, and engineering mechanics.

Course Objectives: The objective of the course is to provide a solid base to study the underlying concepts of fluid properties and behaviour, thereby imparting basic ideas about how an object will behave when it moves through a fluid medium, and the concept of dynamical similarity with application of dimensional analysis to engineering problems.

Course outcome: After the completion of the course the students will be able to

CO 1	Characterize the basic fluid properties and terms associated with the fundamentals of fluid mechanics
CO 2	Estimate hydrostatic forces and stability of the floating and submerged bodies
CO 3	Analyze characteristics of fluids in motion
CO 4	Apply the governing equations for mass, momentum, and energy in practical flow problems
CO 5	Apply dimensional analysis for fluid flow problems for applications in model testing.

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	1										1
CO 2	3	1	2									1
CO 3	3	3	2	1	2		1					1
CO 4	3	3	2	2	1		1					1
CO 5	3	3	2	3	1		1					1

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	15	10	20
Understand	20	20	40
Apply	15	20	40
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0302 FLUID MECHANICS I

Course Content:

Module I

Properties of Fluids Basic fluid properties – Density, specific weight, specific gravity; Viscosity, Newton's law of viscosity, Classification of fluids (Newtonian and non-Newtonian fluids), Kinematic viscosity, pressure, and temperature effects on viscosity; Ideal fluids and real fluids, Vapour pressure, Surface tension and capillarity

Module II

Fluid Statics Pressure due to gravity – Pascal's Law, Absolute and Gage pressure, Static pressure variation, Pressure variation for incompressible and compressible fluids; Measurement of static pressure– anometers:Piezometer, U-tube manometer, Differential manometer; Hydrostatic forces on plane and curved surfaces, walls of containers, center of pressure; Buoyancy and Stability of simple floating shapes – Hydrostatic forces acting on bodies immersed or floating in liquids, Stability of floating bodies; "Solid-Body" Acceleration of liquids – Constant linear acceleration of liquid, steady rotation of liquid.

Module III

Fluids in Motion Classification of fluid flow, One Dimensional Flows: Types of fluid flow – Graphical description of fluid flow – Streamlines, Path lines, Streak lines, Stream tubes; Equation of continuity; Euler's equation of motion – Bernoulli's Equation, Stagnation and total pressure, Applications of Bernoulli equation; Energy equation for unsteady flow; applications of momentum equation, Bernoulli's equation applied to pipe flow, losses in pipes, Impulse and momentum of fluids, Impact of jet on vanes.

Module IV

Flow Measurement Application of Bernoulli's Equation, Flow measuring devices, measurement of internal flow, measurement of discharge - venturimeter, orifice plate, rotameter, measurement of velocity - pitot tube, measurement of external flow - triangular and rectangular notches, coefficient of discharge, calibration of flow measuring devices.

Module V

Dimensional Analysis Dimensionless numbers in fluid mechanics, Reynold's Number, Froude Number, Euler Number, Weber Number, Buckingham Pi Theorem, Law of similitude, significance of non imensionalisation of equations of fluid flow.

References:

1. Frank M White; Fluid Mechanics Seventh Edition Tata McGraw-Hill Publishing Co, Ltd
2. Yunus A Cengel and John M Cimbala; Fluid Mechanics – Fundamentals and Applications, Mc Graw Hill 2021
3. Meihard Schobeiri, Applied fluid mechanics for Engineers, McGraw Hill professional, 2014. 2) Douglas, Gasiorek, and Swaffield; Fluid Mechanics, PHI, 2011.
4. Walther Kaufmann; Fluid Mechanics, Tata McGraw-Hill Publishing Co, Ltd., 1963.
5. G.S Sawhney, Fundamentals of fluid mechanics, I.K. International, 2013.
6. Bruce R Munson & others, Fundamentals of fluid mechanics, Wiley, 2012.
7. Daugherty & Franzini; Fluid mechanics with engg. Applications, International Students Edition McGraw Hill., 1997.
8. Jagdish Lal; Hydraulic machines, Metropolitan book Co., Delhi-, 2000
9. Vallentine; Applied hydrodynamics, Butter Worths, London1970.
10. Bernard S.Massey , revised by John Ward-Smith; Mechanics of Fluids, CRC, 2019.
11. K.L.Kumar; Engineering fluid mechanics, S. Chand, New Delhi, 2016.
12. A.K Jain: Fluid Mechanics including hydraulic machines, Khanna Publishers, 1998.
13. N.S.Govind Rao; Fluid flow machines, Tata Mc Graw Hill., 2002

24-215-0303 PROFESSIONAL ETHICS AND UNIVERSAL HUMAN VALUES

Course Description: The aim of the course is to expose the students to professional ethics and Human Values and also to provide basic familiarity about Engineers as responsible Experimenters, Research Ethics, Codes of Ethics and Industrial Standards.

24-215-0303	Professional Ethics and Universal Human Values	Category	L	T	P	Credit	Year of Induction
		HMC	2	1	-	2	2024

Pre-requisites: Nil

Course Objectives: This course is designed to create awareness on professional ethics and Human Values and inculcate knowledge and exposure on Safety and Risk, Risk Benefit Analysis, Also to provide basic familiarity about Engineers as responsible Experimenters, Research Ethics, Codes of Ethics, Industrial Standards.

Course outcome: After the completion of the course the students will be able to

CO 1	Recall various aspects of ethics and human values.
CO 2	Understand the importance of ethics and human values.
CO 3	Understand the problems faced by engineers and rectify them by applying the ethics and human values.
CO 4	Understand significance of Safety and Risk assessment in industries
CO 5	Understand other types of ethics and role of employees in ethics

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2							3				1
CO 2	2							3				1
CO 3	3	2	2					2				1
CO 4	3	1	1					1				1
CO 5	3	2	2		1			2				2

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0303 PROFESSIONAL ETHICS AND UNIVERSAL HUMAN VALUES

Course Content

Module I

Morals, values and Ethics –Integrity–Work ethic –Service learning–Civic virtue–Living peacefully–Caring–Sharing–Honesty–Courage–Time management –Integrity –Empathy–Self-Confidence-Courage– introduction to Yoga- Yoga as an effective tool for stress management.

Module II

Value education-Introduction to Universal Human values (UHV) – Harmony in four levels - self, family, society and nature

Module III

Case study on 4 levels of Harmony- value education and skill education - Significance of happiness and prosperity in human life.

Module IV

SafetyandRisk–AssessmentofSafetyandRisk–RiskBenefitAnalysis–ReducingRisk– Disasters of all time -Chernobyl and Bhopal Gas tragedy

Module V

Intellectual Property Rights (IPR), Copy right, Patent filing methods. Business Ethics-Environmental Ethics–Cyber security –Engineers as Managers– Conflict of interest in professional life

References:

1. A foundation Course in Human Values & Professional Ethics-r R Gaur, R Sangal,G P Bagaria, Excel books, 2010
2. Jayasree Suresh and B. S. Raghavan, Human Values and Professional Ethics, 3rd Edition, S. Chand Publications .2003
3. The 100 Greatest distasters of all time-Stephen J Spignesi,Citadel Press, 2002
4. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 1999.
5. David Ermann and Michele S Shauf, Computers, Ethics and Society, Oxford University Press, 2003
6. Govindarajan M, Natarajan S, Senthil Kumar V S., Engineering Ethics, Prentice Hall of India, New Delhi 2004.

24-215-0304 INSTRUMENTATION

Course Description: This course covers the basics of measurements, classification of instrument and transducers for various measurements. Instruments which are commonly used for measuring displacement, temperature, pressure, flow, level etc are covered.

24-215-0304	Instrumentation	Category	L	T	P	Credit	Year of Induction
		ESC	3	1	-	3	2024

Prerequisite: Nil

Course Objectives: The objective of the course is to provide the learners a proper understanding of the basic working principles, construction and features of various measuring instruments. And to impart understanding of the intelligent instrumentation.

Course outcome: After the completion of the course the students will be able to

CO 1	Understand the basics of instrumentation, standards, calibration and errors in measurement.
CO 2	Discern the basic working principle and classification of transducers for measurement of displacement, strain, force and pressure
CO 3	Describe the working principle, construction and features of various temperature measuring instruments
CO 4	Explain the working principle, construction and features of various pressure, flow and humidity measuring instruments.
CO 5	Describe various sensors for measurement of nonelectrical quantities in process industries and explore the recent developments in intelligent instrumentation

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	1	1								
CO 2	3	2	1	1								1
CO 3	3	2	1									1
CO 4	3	2	2	1		1						1
CO 5	3	2	1	1		1						2

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0304 INSTRUMENTATION

Course Content

Module I

Introduction: Classification of instruments-Standards and calibration-Errors in instruments and measurements-gross errors-causes and corrective measures-systematic errors- static performance parameters -Dynamic errors –Random errors - Statistical analysis of data and errors- probable error- selection of the instrument.

Module II

Transducers-classification of transducers- Passive Transducers – resistive, Inductive and capacitive Transducers, Active Transducers – Thermoelectric, piezoelectric, magnetostrictive, Hall Effect- Strain gauges- gauge factor-unbounded and bonded resistance strain gauges-resistance strain gauge bridges. Capacitive gauges - L.V.D.T. (Linear variable differential transformer).

Module III

Temperature measurement: Electrical methods - Electrical resistance thermometer-Semiconductor resistance sensors (thermistors) Characteristics –-thermo-electric sensors (thermocouples) -Law of intermediate temperature-Law of intermediate metals Construction-Compensating circuits. Radiation methods - Total radiation pyrometer selective radiation pyrometer- optical pyrometer.

Module IV

Measurement of Pressure: Manometers- elastic transducers-electro mechanical instruments. High pressure measurement. Vacuum gauges-MC Leod gauge-Pirani gauge. Dynamic pressure measurement.

Flow measurement and draft measurement sensors- Electromagnetic flow meters- Laser Doppler anemometer. Measurement of Liquid level-using Gamma rays, float, ultrasonic methods radar type and hydrostatic head type sensor. Hygrometers-dew point methods-Industrial Psychrometer

Module V

Introduction to intelligent Instrumentation -intelligent transducer — comparison with conventional transducers — self-diagnosis and remote calibration features. **Sensors**– Semiconductor Sensors-Classification -Recent trends in sensor technology- Smart Sensors- Micro sensors –Radiation Sensors – Ultrasonic Sensors –Fiber Optic Sensors –Chemical Sensors – Biosensors -Introduction to Programmable Logic controllers Programming-Distributed Control Systems and Computer Based Systems.

References:

1. William C. Dunn, Fundamentals of Industrial Instrumentation and Process Control, McGraw-Hill, 2017.
2. D. Patranabis , Instrumentation and control, PHI Learning, 2011
3. 3. D. Patranabis , Sensors And Tranducers , PHI Learning, 2011
4. B.C. Nakra, K.K.Chaudhary; Instrumentation measurement and Analysis, Tata Mc Graw Hill, 2016.
5. A.K. Sawhney, PuneetSawhney, A Course in Electrical And Electronic Measurements And Instrumentation, Dhanpat Rai Publications, 2015.
6. Joseph J Carr, Elements of Microcomputer Interfacing, Brady (Robert J.) Co, U.S., 1984.
7. Alan S Morris, Reza Langari, Measurement and Instrumentation-Theory and Practice, Butterworth Heinmann, 2011.
8. Oliver B. M. and Cage J. M., “Electronic Measurement and Instrumentation”, McGraw-Hill International

24-215-0305 ANALYSIS OF STRUCTURES

Course Description: The course Analysis of Structures deals with the principles of elastic structural analysis and the various methods involved in the analysis of structures. This course also introduces the student to vibration analysis of discrete and continues bodies, and matrix method for structural analysis.

24-215-0305	Analysis of Structures	Category	L	T	P	Credit	Year of Induction
		ESC	3	1	-	3	2024

Pre-requisites: Engineering Mechanics, Mechanics of Solids.

Course Objectives: This course is designed to impart knowledge on the principles of elastic structural analysis and behaviour of various structures to dynamic loads. It also provides knowledge of different methods for analyzing structures and an introduction to matrix method of structural analysis.

Course outcome: After the completion of the course the students will be able to

CO 1	Understand the concepts of elasticity and plasticity, analysis of fixed end beams, and effects of boundary conditions on beam responses.
CO 2	Apply the methods of moment distribution and three moment equation for the analysis of contiuous beams.
CO 3	Understand the behaviour of beam columns.
CO 4	Apply the concepts of vibration of discrete systems to determine the natural frequencies and vibration response of discrete systems, and understanding vibration of continuous structures with practical applications
CO 5	Analyse one dimensional and two-dimensional structures using matrix methods of structural analysis

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	2	2	2	1	2	1	1				2
CO 2	2	2	2	2	1	2		1				2
CO 3	2	2	2	2	1	2		1				2
CO 4	3	3	2	3	1	2	3	1				3
CO 5	3	3	2	3	1	2	2	1				3

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	20	20	30
Apply	10	10	30
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0305 ANALYSIS OF STRUCTURES

Course Content:

Module I

Revision of method of successive integration, Introduction to elasticity and plasticity, Analysis of fixed end beams, free bending moment, fixed end bending moment, superposition, critical comparison of bending moment and deflections of beams with various end conditions, effect of boundary condition on beam response.

Module II

Continuous beams, continuous beam indealisation in ship structures, Analysis of continuous beams using three moment equation and moment distribution method.

Module III

Stability of beams, (Revision of Euler buckling of columns), Introduction to beam column, differential equation of beam-columns, Energy and Equilibrium criteria for beam columns.

Module IV

Introduction to vibrations of discrete systems, undamped free vibrations of single degree of freedom systems, damped free vibrations, forced vibrations, effects of damping, dynamic stiffness, foundation impedance, concepts of shock and vibration mounting, Introduction to vibrations of continuous systems- Vibration of strings, rods, beams and shafts

Module V

Introduction to Matrix methods in structural analysis, stiffness and flexibility matrices, relations between stiffness and flexibility - Stiffness and flexibility methods for continuous beams and rigidly joined frames

References:

1. Timoshenko & Young; Theory of Structures, McGraw Hill Publications, 1965
2. Reddy, C.S.; Basic Structural Analysis, Tata-McGraw Hill Publications, 2017.
3. W.T.Thomson, M D Dahleh& C Padmanabhan; Theory of vibrations with applications: Person Education, 2008
4. Krishna Raju &Gururaja; Advanced Mechanics of Solids and Structures, Narosa Publications, 1997.
5. Russell. C. Hibbeler; Structural analysis. Ed. 10, Pearson, 2017
6. Aslam Kassimali ; Structural analysis . Cengage Learning, Ed.5, 2015.
7. Przemieniecki, J.S. ; Theory of matrix structural analysis, Dover Publication, 2012
8. Devdas Menon: Structural Analysis: Alpha Science International Limited, 2017
9. Manickasalvam V K: Elements Of Matrix And Stability Analysis Of Structures, Khanna 1999
10. S SBhavikatti: Structural Analysis Vol I &II, Vikas publishing house Ltd,2013
11. L S Srinath: Advanced mechanics of solids, McGraw hill Education,2017.

24-215-0306 MACHINE DRAWING

Course Description: Drawing is the language of Engineers and is the basic medium of communication between them. The course is intended to give basic knowledge in preparing, reading and interpreting production drawing. The rules and codes used for preparing drawings as per international standard, conversion of isometric view to orthographic projections, preparing sectional views from isometric and orthographic projection, drawing machine parts & assembly views.

24-215-0306	Machine Drawing	Category	L	T	P	Credit	Year of Induction
		ESC	1	3	-	3	2024

Pre-requisites: Basic knowledge of engineering drawing.

Course Objectives: This is a practical oriented course which enable students to prepare production drawings as per Indian standard and prepare drawings using various projection methods

Course outcome: After the completion of the course the students will be able to

CO 1	Acquaint with BIS codes, standards and conventions for preparing machine drawings.
CO 2	Convert pictorial views in to orthographic view.
CO 3	Draw sectional views of objects.
CO 4	Prepare drawings of various machine elements.
CO 5	Prepare part drawing and assembly drawing with all information for production like tolerance, surface finish, material, fits etc

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3									2		
CO 2	3	2								2		
CO 3	3	2								2		
CO 4	3	2			2					2		2
CO 5	3	2			2					2		2

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10		10
Understand	15	20	30
Apply	25	30	60
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0306 MACHINE DRAWING

Continuous Internal Evaluation Pattern:

Continuous Assessment : Class work 50% Marks Internal Tests: 50% Marks

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 5 questions of 4 marks each from each module and students should answer all questions. Part B contains 2 questions of 20 marks each from isometric to orthographic conversion, Drawing section from isometric and orthographic projections, machine parts and joints and one question of 40 marks for assembly drawing

Course Content:

Module I

Introduction to the rules of dimensioning, Types, size, location, functional and datum dimensions, principles for dimensioning (IS), dimension figures, notation of dimensioning. Lines, symbols, figures, notes, arrow heads, etc., placing the dimensions, dimensioning angles, arrangement of dimensions, machining symbols and surface finish. Simplifications and conventions-recommended abbreviations, use of symbols and abbreviations, conventions on machine drawing, conventional representation of threads, conventional lines.

Module II

Sectional views, section plane, section lining, full section, half section, partial or broken out section, offset section, removed or rolled section, auxiliary section, aligned section, disposition of successive sections, 20 partial views, developed view, part located in front of a cutting plane, assembly sectioning, sectioning conventions. Conversion of pictorial views into orthographic views, orthographic reading or interpretation of views Sketching

Module III

Drawing of machine elements: - keys, cotters & pin joints, rivets & riveted joints welded joints, screw threads and screw fastening, bearing, brackets and hangers, pipes and pipe joints, gearing springs.

Module IV

Production drawing (types and uses): - Final lay out drawings, general arrangement, assembly drawings, sub-assembly drawings, detail process drawings.

Module V

Information in drawings: material list, modifications, jigs and fixtures, weight, general tolerances, order number, material specifications, heat treatment, surface finish, general comments. Limits and tolerances

References:

1. Basudev Bhattacharya, Machine drawing, OUP, India, 2011.
2. Ajeet Singh, Machine Drawing, Tata McGraw Hill Education, 2017.
3. K.L. Narayanan, Machine Drawing, New age International, 2016.
4. Sadhu singh and P.L.Sah, Fundamentals of Machine drawing, PHI, 2013.
5. David Allen Low, A manual of machine Drawing and design, Longmann Green & Company, 2014.
6. N.D Bhat: Machine Drawing, Charotar Publishing House, Anand., 2014.
7. K.C John: Machine Drawing, PHI, 2009.
8. Narayana, K.L. Machine Drawing 6 PB 450 2019 New Age Publication.

24-215-0307 STABILITY OF SHIPS

Course Description: Fundamental concepts of the stability of ships including transverse stability, longitudinal stability, damaged stability, dynamic stability, and second-generation intact ship stability criteria.

24-215-0307	Stability of Ships	Category	L	T	P	Credit	Year of Induction
		PCC	3	1	-	3	2024

Pre-requisites: Nil

Course Objectives: Enable students to appreciate stability theory and use it to calculate intact and damage stability of ships and to equip them with practical knowledge for conducting inclining experiments and preparing stability booklets.

Course outcome: After the completion of the course the students will be able to

CO 1	Understand the concept of static equilibrium of floating bodies, the importance of various centers of a ship, and the effects of small changes in the ship, its attitude, and the density of water on the centers.
CO 2	Appreciate factors that affect the transverse stability of ships at small heel angles.
CO 3	Compute the various centers and stability of a ship when there are large changes in its attitude. Appreciate the intricacies of an inclining experiment and conduct one.
CO 4	Compute the cross curves of stability for a specified loading condition, perform trim and stability calculation for that loading condition, and check for compliance with the IMO intact stability criteria.
CO 5	Estimate trim of a ship resulting from addition, removal, and shifting of weights and due to change in density of water. Compute flooded attitude, floodable length curves, and design the positions of bulkheads.

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	1	1									
CO 2	3	2	1	1								
CO 3	3	3	1	1	1							1
CO 4	3	3	1	1	1							
CO 5	3	3	1	1	1							

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	15
Understand	20	20	35
Apply	20	20	50
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0307 STABILITY OF SHIPS

Course Contents:

Module I

Equilibrium of ships: Conditions for static equilibrium of a floating body, Archimedes Principle, Hydrostatic pressure distribution on floating cuboids and bodies of arbitrary shape, Stevin's Law. Small changes from equilibrium position, Three types of equilibrium, Small vertical change in the position, small inclination. Bouguer's Metacentre. Euler's Theorem and the axis of inclination, Centre of flotation. Change in the density, Fresh water allowance, Dock water allowance, Plimsoll line. Change in the centre of gravity, Movement of a mass on-board, Addition or removal of a mass. Change in the centre of buoyancy, Addition or removal of a small, medium, and large masses. Small and large changes in the attitude, Curve of centres of buoyancy. Change in the metacentre, Metacentric radius. BM = I/V, Metacentric Evolute, Metacentric height.

Module II

Initial Transverse Stability of ships: Righting lever arm, GZ, Lever arm of stability of weight. $\boldsymbol{GZ = GM \sin \phi}$, Lever arm of stability of form. Heeling of wall-sided ships, Change in the CoB, metacentre, and Atwood's formula for GZ. Finding M using curves of CoB and BM. Adverse effects on the righting lever arm due to vertical and horizontal movement of mass, Addition of mass, Suspended or hanging load, and Free-surface effect. Inclining experiment. Stability of grounded or docked ships. Rolling of ships, Stiff and tender ships

Module III

Stability of Ships at Large angles: Curve of statical stability. GZ(ϕ), Heeling to either side (positive and negative angles of heel), Critical angles. Angle of loll. Cross-curves of stability, Effect of ship dimensions, load distribution and attitude, and environment on the GZ. Intact stability regulations. Large change in the attitude of a ship. Prohaska and Krylov methods for calculating the GZ curve. CoB as a function of BM. Dynamic stability, Different Characteristic curves of dynamic stability, Dynamic stability criteria, Roll or heel test

Practical: Krylov method applied to a barge with a uniform trapezoidal cross-section

Module IV

Longitudinal Stability: Longitudinal metacentre, Trim and MCT1cm, Longitudinal centre of flotation. Change of trim and draft due to addition, removal, and movement of load. Effect of density on trim and draft. Rules on draft and trim and freeboard. Triam and stability booklet. Stability in waves. Second-generation intact ship stability criteria.

Module V

Damaged Stability: Bilging, Surface and volume permeability. Effect of bilging of midship, end, and side compartments. Floodable length curve.

Practical: Floodable length calculation and subdivision of ship. Stability in waves,

References

1. Adrian Biran, Ship Hydrostatics and Stability. 2nd Ed. Elsevier. 2013.
2. V. Semyonov-Tyan-Shansky. Statics and Dynamics of the Ship. Peace publishers, Moscow, 2004.
3. Colin S. Moore, Principles of Naval Architecture Series: Intact stability, SNAME, New Jersey, 2010.
4. E. C. Tupper and KJ Rawson. Basic Ship Theory. Combined Volume. 5th Edition. 2001.
5. Philip A. Wilson. Basic Naval Architecture. Ship Stability. Springer. 2018.
6. A. R. Lester, Merchant Ship Stability. Butterworths, 1985.
7. H. Subramanian, Ship Stability, Nutshell series Book 4, Parts 1, 2, and 3. Vijaya Publications, Mumbai.
8. C. B. Barrass and D. R. Derrett, Ship Stability for Masters and Mates. 7th Ed. Butterworth-Heinemann. 2012.

24-215-0308 ELECTRICAL ENGINEERING LAB

Course Description: This lab mainly focuses on to develop a platform where the students can enhance their engineering knowledge in basic electrical engineering and to apply theoretical knowledge they acquired. This lab provides practical experience on various electrical equipments.

24-215-0308	Electrical Engineering Lab	Category	L	T	P	Credit	Year of Induction
		ESC			3	2	2024

Prerequisite: Basic electrical engineering knowledge on circuits and machines

Course outcome: After the completion of the course the students will be able to

CO 1	Perform basic electrical wiring, select fuse for a given electrical circuit and perform electrical measurements using different meters and instruments
CO 2	Measure power and power factor in single-phase and three-phase ac circuits
CO 3	Acquire hands on experience of conducting various tests on induction machines and obtaining their performance indices
CO 4	Acquire hands on experience of conducting various tests on machines and obtaining their performance characteristics.
CO 5	Acquire hands on experience of conducting various tests on transformers and obtaining their performance characteristics.
CO 6	Function as a member of a team and prepare laboratory reports that clearly communicate experimental information in a logical and scientific manner.

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2		1			1						
CO 2	3											
CO 3	2											1
CO 4	3	2										1
CO 5	2	1								1		1
CO 6	2		1			1						

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	5	5	-
Understand	10	10	-
Apply	10	10	-
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0308 ELECTRICAL ENGINEERING LAB

List of Experiments

1. a) Familiarization of wiring tools, lighting and wiring accessories, various types of wiring systems. Study of Electric shock phenomenon, precautions, preventions, Earthing. Study of Fuse, MCB, ELCB – Selection of Fuse rating for circuits.
   b) Wiring of one lamp controlled by one switch.
   c) Wiring of one lamp controlled by two SPDT Switches and one 3 pin plug socket independently.
2. Three phase power measurement. a) Two wattmeter method b) Three wattmeter method
3. Load test on a dc shunt generator, determination of internal/ external characteristics and analysis
4. Load test on DC series and Shunt motors to plot performance characteristics
5. OC and SC tests on a single-phase transformer and predetermination of efficiency/ regulation
6. Load test on a single-phase induction motor, to plot performance characteristics

References:

1. H Cotton, Advanced Electrical Technology, Reem Publications, 2011.
2. EW. Golding, Electrical Measurements and Measuring Instruments, 5th ed. Reem Publications,2011.
3. Clayton A E & Hancock N N, Performance and Design of DC Machines, ELBS,1971.
4. Nagarath I J & Kothari D P, Electric Machines, Tata McGraw Hill, 1999.
5. Say M G, The Performance and Design of AC Machines, CBS, 1983.

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24-215-0309 INTERNSHIP

Course Description: Impart students the application of theoretical knowledge on practical work related to Naval Architecture. Work experience is cooperatively planned by the department and employer to fulfill the student's objectives.

24-215-0309	Internship		Category	L	T	P	Credit	Year of Induction
			PCC	-	-	-	2	2024

Course outcome: After the completion of the course the students will be able to

CO 1	Apply classroom and laboratory concepts and principles in a Shipping industry related working environment.
CO 2	Establish goals by working with supervision to define work objectives for the internship experience.
CO 3	Demonstrate time and project management skills by completing the work objectives within the specified time limits.
CO 4	Demonstrate the ability to effectively present ideas and solutions in the context of written, oral, and electronic media.
CO 5	Demonstrate the ability to work as a team member to successfully complete the assigned work objectives in an assigned company work group.
CO 6	Demonstrate and promote a proper work ethic.

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	3	2	2		2					3
CO 2	3	2	1			3	3					
CO 3	3	3			2	3	1				3	
CO 4	3	1	1		3					3		
CO 5	3	3				2		2	3	3	3	
CO 6	3	3				1		3			1	

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	5	5	-
Understand	10	10	-
Apply	10	10	-
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0309 INTERNSHIP

Assessment Pattern:

Each student will work with their supervisor from the concerned company/organization to jointly develop projects / activities, which will be accomplished during the internship program. The projects/activities should be unique and must be related to the knowledge and/or skills attained during their degree program in Naval Architecture and related areas. The projects must be approved by the instructor/supervisor from the concerned industry/company and/or lead faculty member from the Department of Ship Technology, CUSAT.

Assessment Method:

Each student is required to maintain a comprehensive daily work log detailing their activities. This log should be generated using a word processing software such as Word or a database program like Excel. Emphasis should be placed on maintaining a professional and well-organized format. It is essential to record major activities undertaken on each day of work, ensuring that adequate detail is provided to sufficiently describe the performed tasks. While the following format is suggested, it is imperative to ensure that the log captures a thorough depiction of the work conducted:

Cochin University of Science and Technology **Department of Ship Technology** **Daily Log (Template)**
Course and Semester:
Name of the student:
Name of the Employer:
Supervisor's Name:
Date:
Activities for the particular date:

Furthermore, students are required to maintain precise documentation of their internship projects in an engineering notebook. **The notebook must be securely bound and should have page numbers**. Its primary purpose is to serve as a repository for key meetings, ideas, outcomes, observations, references, and all pertinent information associated with the internship. Entries into the notebook should be made directly in ink. This meticulous documentation ensures a thorough and replicable record of the internship's activities and outcomes.

Mark distribution:

Total Marks	CIE	ESE	ESE Duration
50	50	-	-

The assessment will remain exclusively internal. The allocation of marks for the training program adheres to a scale of 50, categorized as follows: 20 marks attributed to the internship workbook, endorsed by the supervisor; 20 marks assigned to the viva voce examination; and 10 marks designated for the final report submitted during the viva voce session.

SEMESTER IV

24-215-0401 MATHEMATICS IV (NUMERICAL METHODS IN ENGINEERING)

Course Description: To equip students with concepts of Solution of problems using Numerical Methods which has wide applications in Engineering problems.

24-215-0401	Mathematics IV (Numerical Methods in Engineering)	Category	L	T	P	Credit	Year of Induction
		BSC	3	1	0	3	2024

Pre-requisites: Nil

Course objectives: This course introduces the concepts and applications of Numerical Methods of solution of problems which have applications in all branches of engineering.

Course outcome: After the completion of the course the students will be able to

CO 1	To solve Linear Algebraic Equations using numerical methods
CO 2	To solve Non-Linear Algebraic Equations using numerical methods
CO 3	Working of Difference operators and their inter relations
CO 4	To familiarize with Numerical Methods for Ordinary Differential Equation
CO 5	To solve Partial Differential Equations using Numerical Methods

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	1				2	1					2
CO 2	1	1										
CO 3	2	2		2	2							
CO 4	3	2	1	1	2							1
CO 5	3	2	2	2		2	2					1

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0401 MATHEMATICS IV (NUMERICAL METHODS IN ENGINEERING)

Course Content:

Module I

Solution of Linear Algebraic Equations by the methods of Gauss and Gauss-Jordan. Iteration methods of Jacobi and Gauss-Seidal. Relaxation methods

Module II

Regula-Falsi method and Newton-Raphson Method for non-linear equation in one variable. Horner‘s Method and Graeffe‘s Root squaring Method for polynomial equation.

Module III

Difference operators and their inter-relations. Newton ‘s forward and backward interpolation formulae. Lagrange Interpolation; Numerical differentiation, centre difference operators, central difference formula

Module IV

Numerical Methods for Ordinary Differential Equations. Taylor Series Method. Picard‘s Method. Runge-Kutta Method of the fourth order. Orders of errors to be mentioned, Milne ‘s predictor corrector method.

Module V

Harmonic Analysis. Estimation of Fourier coefficients given values of a function at specific values in its domain. Difference formulae for partial derivatives (only two dimensions need to be considered). Numerical methods for solving parabolic and elliptic partial differential equations in Cartesian co-ordinates only as in conduction of heat in infinitely long plates and steady state temperature distribution in finite rectangular plates.

References:

1. Kreyzig, E.; Advanced Engineering Mathematics, Wiley, New York, 2011.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna publishers, New Delhi, 2
3. N P Bali, Manish Goyal,ATextbook of Engineering Mathematics, Ninth Edition, Laxmi Publications
4. John Bird, Higher Engineering Mathematics, Rowlledge, 2010.
5. R.K.jain, S.R.K Iyengar, Advanced engineering mathematics, Narosa, 2012

24-215-0402 RESISTANCE OF SHIPS

Course Description: The goal of this course is to introduce the students to the fundamental concepts in ship resistance, its prediction and estimation of power required to achieve a specified speed. It is also intended to impart knowledge on the developments in hull forms and their design using modern day engineering tools and techniques.

24-215-0402	Resistance of Ships	Category	L	T	P	Credit	Year of Induction
		PCC	3	1	-	3	2024

Pre-requisites: Basic Fluid Mechanics and Engineering Mathematics.

Course Objectives: This is an introductory course, designed to provide the fundamental concepts of ship resistance and modern scientific approach in powering calculations. It exposes the students to the connection between basic fluid mechanics and the application of hydrodynamics in daily ship design practice.

Course outcome: After the completion of the course the students will be able to

CO 1	Understand the various components of ship resistance; application of dimensional analysis and similarity laws in determination of resistance.
CO 2	Understand the components of viscous resistance and pressure resistance in detail that contribute to the total resistance of a surface ship.
CO 3	Understand the principles of various model testing facilities and methods of predicting full-scale resistance from model tests applying similarity laws and accounting for scale effects.
CO 4	Estimate resistance of ships and effective power using statistical / methodical series. Apply standard series data for estimating ship propulsive power for various ship types and size, particularly at the preliminary design stages.
CO 5	Understand the effect of restricted water ways on the resistance of conventional displacement hulls.

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2											2
CO 2	3	2	2	2	1							1
CO 3	2	2	2	2	1							1
CO 4	2	2	2	2	1		1					2
CO 5	2	1	1	1			1					1

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	20	20	50
Apply	20	20	30
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0402 RESISTANCE OF SHIPS

Course Content:

Module I

Components of ship resistance, Dimensional analysis.

Laws of comparison – geometrical, kinematical and dynamical similarity, Froude ‘s and Reynold ‘s law, model-ship correlation.

Module II

Viscous resistance – turbulent plate friction and plate resistance, viscous pressure resistance, separation and resistance due to separation, influence of curvature of the ship ‘s hull, form factor, hull roughness and its influence on frictional resistance. Wave making resistance – pressure resistance, ship wave system, interference effects, theoretical calculation of wave-making resistance, wave breaking resistance, bulbous bows and their effects.

Module III

Model testing – tank testing facilities, testing, prediction of resistance from model tests, extrapolation, Froude ‘s concept, laminar influence and tank wall effect, comparison of resistance prediction with results of full-scale trials.

Module IV

Determination of resistance from series test results – residuary resistance, effect of hull form on resistance, Taylor series, Series 60, B S R A series, S S P A series, etc.; statistical analysis of resistance data, Guldhammer-Harvald ‘s and Danckwardt ‘s method.

Module V

Air and wind resistance, Resistance of appendages, Added resistance in waves; Resistance in restricted waterways – resistance in shallow water, resistance in canals.

Practical: - Resistance calculation using Guldhammer and Harvald series, shallow water resistance calculation, model – ship correlation; modelling and analysis of standard hull forms using modern engineering tools – software packages.

References:

1. Lothar Birk (2019). Fundamentals of Ship Hydrodynamics: Fluid Mechanics, Ship Resistance and Propulsion, First Edition, Wiley, 2019.
2. William Froude and Robert Edmund Froude; Resistance of Ships, primary source edition, Nabu Press, 2014.
3. Jonathan Ridley and Christopher Patterson: Ship Stability, Powering and Resistance, Vol. 13, Ed. 13, Thomas Reed Publications, 2014.
4. William Frederick Durand: Resistance and Propulsion of Ships, Nabu Press, 2013.
5. D. W. Taylor: Resistance of Ships and Screw Propulsion, Unikum, 2012.
6. G. S. Baker: Ship form, resistance and screw propulsion, 2010.
7. John Letcher, Randolph Paulling: Principles of Naval Architecture series – Ship Resistance and flow, SNAME, New Jersey, U.S.A., 2009.
8. Harvald S. A.: Resistance and Propulsion of Ships, John Wiley & Sons, 1983.
9. Antony F. Moland, Stephen R. Turnock: Ship Resistance and Propulsion – Practical Estimation of Propulsive Power, Cambridge University Press, 2011.

24-215-0403 FLUID MECHANICS II

Course Description: This course covers basics of potential flow analysis for inviscid flows, fundamental concepts of vortex motion, connections between circulation and lift, generation of drag in the boundary layer and Navier-Stokes equations for viscous flows: including pipe flows

24-215-0403	Fluid Mechanics II	Category	L	T	P	Credit	Year of Induction
		ESC	3	1	-	3	2024

Pre-requisites: Knowledge in the fundamentals of fluid mechanics and basic engineering courses like engineering physics, engineering mathematics: calculus and differential equations, elementary vector and tensor algebra, and engineering mechanics.

Course Objectives: The objective of the course is to understand the fundamental concepts of potential flow, ideal flow, vortex motion, boundary layer formation and development of forces on streamlined bodies, flow in pipes, connections between circulation and lift, generation of drag in the boundary layer, thereby laying a solid background to comprehend the core subjects of the programme.

Course outcome: After the completion of the course the students will be able to

CO 1	Recall the basic properties of ideal flow and develop an understanding of fundamental concepts of flow with circulation, potential flow and vortex motion
CO 2	Understand the fundamental concepts of fluid flow and apply the boundary layer concepts to analyse the behaviour of an object as it moves through a fluid medium.
CO 3	Analyse the behaviour of viscous flow in pipes or ducts and ability to solve for internal flow through simple solutions of the Navier-Stokes equations, Moody chart and head-loss equations.
CO 4	Describe and analyse turbulent flow, and turbulence
CO 5	Evaluate lift and drag for external flows and understand the fundamental concepts of computational methods

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	1									1
CO 2	3	2	3	2			1					2
CO 3	3	3	2	2	1	2	2					2
CO 4	2	3	2	3	2		1					2
CO 5	2	3	3	2	2	2	1					2

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	15	10	20
Understand	20	20	40
Apply	15	20	40
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0403 FLUID MECHANICS II
Course Content:

Module I

General theory of two and three-dimensional flow: -Continuity equation, Euler ‘s equation of motion (review). Circulation, Stoke ‘s integral theorem. Generalised Bernoulli ‘s equation, sources, sinks, dipole, Flow with circulation, potential flow with rotational symmetry, hydrodynamical lift, Kutta-Joukowski theorem. Vortex motion-Fundamental concepts, vortex analogy to Biot-Savart ‘s law, straight parallel vortex filaments, vortex sheets.

Module II

Differential Analysis of Fluid Flow- Conservation of mass – Continuity equation, Stream function. Viscous flow-Navier-Stoke ‘s equations – exact solutions. Approximate Solutions of Navier Stokes equation – Creeping flow approximation. Boundary Layer Approximation- Boundary layer theory-The Boundary Layer Equations, The Flat-Plate Boundary Layer Prandtl ‘s boundary layer equations, criterion for separation, Blasius solution, Skin friction, displacement thickness, momentum thickness, turbulent boundary layer, Integral and differential equations of boundary layer, Order of magnitude analysis of boundary layer, Boundary Layers with Pressure Gradient

Module III

Internal Flow - Laminar Flow in Pipes – Pressure drops and head loss, effect of gravity and velocity on flow rate in laminar flow - Hagen-Poiseuille equation - Couette Flow. Turbulent flow in Pipes – turbulent shear stress, turbulent velocity profile, Moody chart and its associated equations.

Minor losses - Minor or Local Losses in Pipe Systems, Multiple-Pipe Systems, Pipes in Parallel, Pipe Networks

Module IV

Turbulent flow- Turbulence Modelling: Reynolds’ Time-Averaging Concept, The Logarithmic Overlap Law, Equations of turbulent flow, turbulence closure problem, turbulent models, Reynolds Averaged Navier Stokes Equation

Module V

Drag and Lift, Friction and pressure drag, Drag coefficients of common geometries, Flow over flat plates, cylinders, spheres.

Lift – Finite span wings and induced drag, circulation, pressure distribution-theory of thin air foils, circulation distribution, Cavitation.

Introduction to Computational Methods in Fluid Dynamics, Application of CFD in fluid mechanics.

References:

1. Frank M White; Fluid Mechanics Seventh Edition Tata McGraw-Hill Publishing Co, Ltd.
2. Yunus A Cengel and John M Cimbala; Fluid Mechanics – Fundamentals and Applications, Mc Graw Hill 2021
3. Walther Kaufmann; Fluid Mechanics, Tata McGraw-Hill Publishing Co, Ltd., 1963.
4. Schlichting; Boundary Layer Theory, Springer Verlag, 2001.
5. Vallentine; Applied Hydrodynamics, ELBS, 1967.
6. Joseph H Spurk, Fluid Mechanics, Springer, 2008.
7. Meihard Schobeiri, Applied fluid mechanics for Engineers, McGraw Hill professional, 2014.
8. Douglas, Gasiorek, and Swaffield; Fluid Mechanics, PHI, 2011.
9. G.S Sawhney, Fundamentals of fluid mechanics, I.K.International, 2013.
10. Bruce R Munson & others, Fundamentals of fluid mechanics, Wiley, 2016.
11. Hibbeler, R.C., Fluid Mechanics, Pearson, 2017
12. A.K Jain; Fluid Mechanics including hydraulic machines, Khanna Publishers, 1998.
13. Pijush K. Kundu, Ira M.Cohen and David R. Dowling; Fluid Mechanics, AcademicPress,2014.
14. John D Anderson, Computational Fluid Dynamics the Basics with Applications, Mc Graw Hill 2017.

24-215-0404 DESIGN OF MACHINE ELEMENTS

Course Description: Design engineer needs to design various elements of machines considering safety, durability, economical and ergonomical aspects, environmental impact etc. To accomplish this, he has the capability of identifying the load, material properties, safety requirements, failure mode etc under the given working condition. This course is intended to develop such a design skill.

24-215-0404	Design Of Machine Elements	Category	L	T	P	Credit	Year of Induction
		ESC	2	2	-	3	2024

Pre-requisites: Basic knowledge of Engineering mechanics, Mathematics and mechanical properties of materials.

Course Objectives: This is a practical oriented course which enable students to design machine parts as per BIS standards and codes.

Course outcome: After the completion of the course the students will be able to

CO 1	Identify machine elements subjected to steady load, variable load and shock load.
CO 2	Apply the concept of factor of safety, stress concentration factor, standardization, theories of failure in design problems.
CO 3	Evaluate the stress induced in the elements due to various loading conditions.
CO 4	Select suitable materials for the design
CO 5	Design various mechanical elements considering strength, safety, durability, economy, ergonomics and its environmental impact

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	2									
CO 2	3	3	2									
CO 3	3	3	2									
CO 4	3	3	2									
CO 5	3	3	2		2		2		2			2

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	15	15	30
Apply	25	25	60
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0404 DESIGN OF MACHINE ELEMENTS

Course Content:

Module I

Fundamentals of machine design: -, design process and principles; Stresses in machine parts-working stress, safe stress, factor of safety, endurance limits in fatigue loading

Elastic springs-classification and uses of springs-allowable stresses and deflections-design for static and fluctuating loads.

Module II

Joints: -Detachable joints: Knuckle and cotter Joints, Non detachable joints: welded joints, riveted joints, strength of welded and riveted joints.

Module III

Shafts for power transmission - torsion and bending of shafts, design of shafts based on strength and torsional rigidity .

Module IV

Keys: - Types of keys, Significance and application of keys in power transmission.

Shaft couplings: -Design of Rigid coupling and flexible couplings.

Module V

Bearings: - Slide bearings-introduction to lubrication, hydrodynamic bearings, bearing materials, design of slide bearings. Roller bearings- types, static & dynamic load, capacity, bearing life and selection of Bearings.

Gears: - Types (spur and parallel helical gears) and function of gears, strength of gear teeth, stresses and stress concentration in gears-design of gears.

References:

1. J.E.Shigley: Mechanical Engineering Design, McGraw-Hill., 2003.
2. R.K.Jain; Machine Design, Khanna Publications, New Delhi, 2017.
3. Bhandari.V; Design of machine elements, McGraw Hill education, 2017.
4. P.C.Sharma, D.K.Aggarwal: A text book of machine design, S.K.Kataria& sons, 2013.
5. K. Mahadevan and Dr. K. Balaveera Reddy, Design data hand book,CBS Publishers , 2014
6. U.C. Jindal, Machine design, Pearson education, 2010.

24-215-0405 APPLIED THERMODYNAMICS

Course Description: Covers principles of classical thermodynamics. Develops understanding of mass, energy, heat, work, efficiency, ideal and real thermodynamic cycles, thermodynamics processes, internal combustion engines, properties of steam, principles and modes of heat transfer, refrigeration and air-conditioning. Covers first and second laws of thermodynamics, perfect gas law, properties of real gases, and the general energy equation for closed and open systems.

24-215-0405	Applied Thermodynamics	Category	L	T	P	Credit	Year of Induction
		ESC	3	1	-	3	2024

Pre-requisites: Nil

Course Objectives: is to impart knowledge on fundamental concepts and laws of thermodynamics and to introduce the various thermodynamic processes & cycles and to impart knowledge on the properties of pure substances and modes of heat transfer. Also, to introduce the principle of operation of steam nozzles, turbines, internal combustion engines, refrigeration systems and air-conditioning systems.

Course outcome: After the completion of the course the students will be able to

CO 1	Apply thermodynamics laws for practical engineering applications
CO 2	Demonstrate understanding of the working of internal combustion engines
CO 3	Able to solve heat transfer problems involving conduction, convection and radiation
CO 4	Analyze the performance of refrigeration systems
CO 5	Demonstrate understanding of the principle and operation of air-conditioning systems.

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	2	1								1
CO 2	3	2	2									1
CO 3	3	2	2	1								
CO 4	3	2	2									1
CO 5	3	2	2									1

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	20	20	40
Apply	20	20	40
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0405 APPLIED THERMODYNAMICS
Course Content:

Module I

Introduction: Basic definitions (System, Control volume, work, heat property, process etc.); Zeroth law of thermodynamics; Ideal gas-equation of state.

First law of thermodynamics

Closed system undergoing a cycle; closed system undergoing a change of state; Internal energy of a system; Expansion work; Process using ideal gas -constant pressure, constant volume, isothermal; adiabatic and polytropic process -work done and heat added in different process; First law applied to one -dimensional steady flow process, flow energy, steady flow energy equation (ID).

Second law of Thermodynamics

Different statements; Reversible and irreversible process; Corollaries of second law - Absolute temperature scale; Carnot cycle -Carnot engine, refrigerator and heat pump. Clauscius inequality and definition of entropy, change of entropy of an ideal gas. Pure substance. Equilibrium diagram -T-s, p-V, p-T, h-s, etc.

Module II
Gas power cycles and I.C.Engines: Gas power cycles: Carnot cycle, Brayton cycle, Erricson cycle, Sterling cycleetc.; Air standard cycles-Otto-Diesel, Dual and Joule cycle; Evaluation of thermal efficiency and mean effective pressure. Internal Combustion engine: Classification of I.C. engines -Principle of operation of spark Ignition and Compression Ignition engines both two stroke and four stroke, Stages of combustion in S.I. and C.I. engines
Knocking and detonation-factors controlling knock and detonation, methods of preventing Knocking and detonation

Steady State Heat Transfer: Modes of heat transfer and their mechanisms, Conduction Fourier ‘s law of heat conduction-Heat conduction through composite walls and cylinders

Module III
Steady state heat convection, Free and forced convection-Definition of Nusselt, Reynolds, Praudtl and Grashoff's number and their significance. Estimation of convective heat transfer coefficient using empirical formula for free convection over horizontal and vertical plates and cylinders, forced convection thorough pipes.

Heat exchangers: Different types-Log mean temperature difference for parallel flow and counter flow heat exchangers, Radiative heat transfer, Emissive Power-Stephan Boltzmann law-Definition of black body, grey body, Emmissivity, Absorptivity etc.,Kirchoff‘s law of radiation. Estimation of heat transfer by radiation for sample cases like infinite parallel planes infinite concentric cylinders, and concentric spheres

Module IV
Refrigeration: Definition and purpose, Principle of operation of Simple vapour compression system. Representation on T.S. and p-h charts. Estimation of coefficient of performance and refrigerant flow rate. Factors affecting coefficient of performance. Absorption refrigeration system, Comparison with vapour compression systems. Principle of operation of vapour absorption system like Aqua ammonia system, Electrolux system, Lithium bromide absorption refrigeration system etc., Steam jet refrigeration system working principle, Refrigerants, Classification and designation-properties and requirements-Important refrigerants like NH3, CO2, Methyl chloride, Methylene chloride, Freon ‘s etc. Factors influencing selection of refrigerants. Secondary refrigerants.

Module V

Air conditioning principles: Definition and purpose, Psychometry-psychrometric properties of air-Psychrometric chart-Adiabatic saturation, Psychrometric process, Sensible heating and cooling, Humidification and dehumidification, Cooling and humidification, Cooling and dehumidification-Heating and humidification, Heating and dehumidification, Adiabatic mixing of air streams –cooling and heating load calculations, Summer and winter air conditioning – Estimation of the state of supply air to the conditioned space-Quantity of air supply etc. for simple winter air conditioning systems.

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24-215-0406 -MATERIALS SCIENCE

Course Description: The aim of this course is to offer students a solid background in the fundamentals of materials-conceptual perspective for origin of materials, structure/property/performance correlation and to impart that knowledge in engineering disciplines. The program is designed to develop scientific attitudes and enable the students to connect the concepts of material science with the core programme.

24-215-0406	Materials Science	Category	L	T	P	Credit	Year of Induction
		ESC	3	1	-	3	2024

Pre-requisites: Higher Secondary Level physics, Chemistry and Mathematics of materials.

Course Objectives: This is an Engineering course, designed to provide the fundamental concepts of Materials and their application by comprehending the structure, properties and processing and their relationships for metallic, ceramic, polymeric, composite materials and advanced materials.

Course outcome: After the completion of the course the students will be able to

CO 1	Recognize/recall the various types of materials with structure property correlation and understand metallic materials based on structure, properties, processing and applications
CO 2	Comprehend the phase diagram for various alloys and apply this to the heat treatment for different alloys.
CO 3	Apply mechanical testing of materials to differentiate various materials
CO 4	Evaluate metallic and non-metallic materials based on structure, properties, processing and applications for designing engineering application
CO 5	Understand advanced materials based on structure, properties, processing and applications.

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	1	1	1									
CO 2	2	3	1									
CO 3	2	3	1									
CO 4	2	3	1									
CO 5	2	2	1									

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
200	100	100	3 hours

24-215-0406 -MATERIALS SCIENCE

Course Content:

Module I

Introduction to materials Science and its importance, Classification of materials, Structure properties correlation-Atomic structure and Crystal Structure, single and polycrystalline structures, Packing geometry in metallic materials, Crystal planes - and directions, Crystal Defects, point, line, surface and volume defects, Diffusion, Fick's 1st and 2nd law equation

Module II

Phase Transformation and Phase Diagram: Nucleation& Growth, homogeneous& heterogeneous nucleation,
Phase rule, isomorphous system, lever rule, eutectic, peritectic, eutectoid & peritectoid system, ternary diagram, iron-carbon diagram, T-T-T diagram, Annealing, normalizing, hardening& tempering, recovery, recrystallization & grain growth, Precipitation hardening, Structure of ferrous and nonferrous alloys.

Module III

Mechanical Properties: Plastic deformation, slip twinning, Critical resolved shear stress, theoretical shear strength of perfect crystal, role of dislocation in plastic deformation, viscoelasticity, methods of strengthening crystalline materials. Stress-strain diagrams of metallic, ceramic and polymeric materials, hardness, hardenability, impact strength, creep, fatigue, ductile and brittle fracture

Module IV

Structural materials: Metallic Materials-Ferrous materials, their classification, composition, properties and application. Non-Metallic Materials-Non-ferrous materials, their classification, composition, properties and application.

Module V

Advanced Materials: Smart materials, Nanomaterials, Shape Memory alloys, Piezoelectric materials, Mangetostrictive materials, Sensors, Optical fibre, Micro elctro mechanical systems (MEMS), Energy Materials - Photovoltic, Solar cells, Metamaterials, super alloys, self-assembly, bio-inspired materials.

References:

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24-215-0407 FLUID MECHANICS LAB

Course Description: This lab is mainly focused to develop a platform where the students can enhance their engineering knowledge in the fluid mechanics domain by applying their theoretical knowledge acquired.

24-215-0407	Fluid Mechanics Lab	Category	L	T	P	Credit	Year of Induction
		ESC	1	-	2	2	2024

Prerequisite: Nil.

Course Objective: The objective of this training is to familiarize the major instruments commonly used in the field of fluid mechanics and practice different experiments in the fluid mechanics domain

Course outcome: After the completion of the course the students will be able to

CO 1	Identify major instruments commonly used in the field of fluid mechanics.
CO 2	Identify and practice different experiments in the fluid mechanics domain.
CO 3	Apply the theoretical knowledge gained in the class room with the physical world.
CO 4	Compare different techniques and instruments used in Fluid flow measurements.
CO 5	Carry out scientific experiments as well as accurately record and analyse the results of such experiments.
CO 6	Function as a member of a team, communicate effectively and engage in further learning and problem solving.

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3								1			1
CO 2	3	3			2							1
CO 3	3	3		3								1
CO 4	3	3			2							1
CO 5	3	3	3		1			2	1			1
CO 6	3								1			1

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	20
Analyse			
Evaluate			

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE** Duration
50	50	-	-

24-215-0407 FLUID MECHANICS LAB
Continuous Internal Evaluation Pattern:

Continuous Assessment : Class work 50% Marks Internal Tests: 50% Marks

List of Experiments

1. Pressure measurements
2. Velocity and rate of flow measurements
3. Verification of Bernoulli's Theorem
4. Calibration of Venturimeter
5. Determination of Friction factor
6. Critical velocity and Reynold 's number at steady pipe flow
7. Calibration of small orifices and Notches
8. Determination of metacentric height of a floating model

24-215-0408 MODEL MAKING TECHNIQUES LAB

Course Description: Ship models helps to scale down the dimensions of a ship so that all important parameters of a prototype can be estimated and analysed on a model scale and finally extrapolated to full scale. Models are useful for stability study, sea keeping and manoeuvring characteristics study, resistance and propulsion tests.

24-215-0408	Model Making Techniques Lab	Category	L	T	P	Credit	Year of Induction
		PCC			3	2	2024

Prerequisite: Nil

Course Objective: i) To impart knowledge of various types of modelling materials and methods used in ship model making. ii) To gain practical exposure on handling tools and machineries used in model making

Course outcome: After the completion of the course the students will be able to

CO 1	Understand various types of models used in ship building industry.
CO 2	Understand various materials, **tools** and techniques used in ship model making.
CO 3	Make ship models using pattern and frame method.
CO 4	Apply the knowledge gained in the class room with the physical world.
CO 5	Improve the skills of using various hand tools and machineries.
CO 6	Function as a member of a team, communicate effectively and engage in further learning and problem solving.

Mapping of course outcomes with program outcomes: Level - Low (1), medium (2) and high (3)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2		1							1		1
CO 2	3									1		1
CO 3	2									1		1
CO 4	3	2								1		1
CO 5	2	1								1		1
CO 6	1								1	1		1

Assessment Pattern:

Bloom 's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	5	5	-
Understand	10	10	-
Apply	10	10	-
Analyse			
Evaluate			

Mark distribution

Total Marks	CIE	ESE	**ESE** Duration
50	50	-	-

Continuous Internal Evaluation Pattern:

Continuous Assessment : Class work 50% Marks Internal Tests: 50% Marks

List of Experiments

2. Study on tools and machineries used in model making
3. Preparation of drawings
4. Model making using pattern method
5. Model making using frame method