

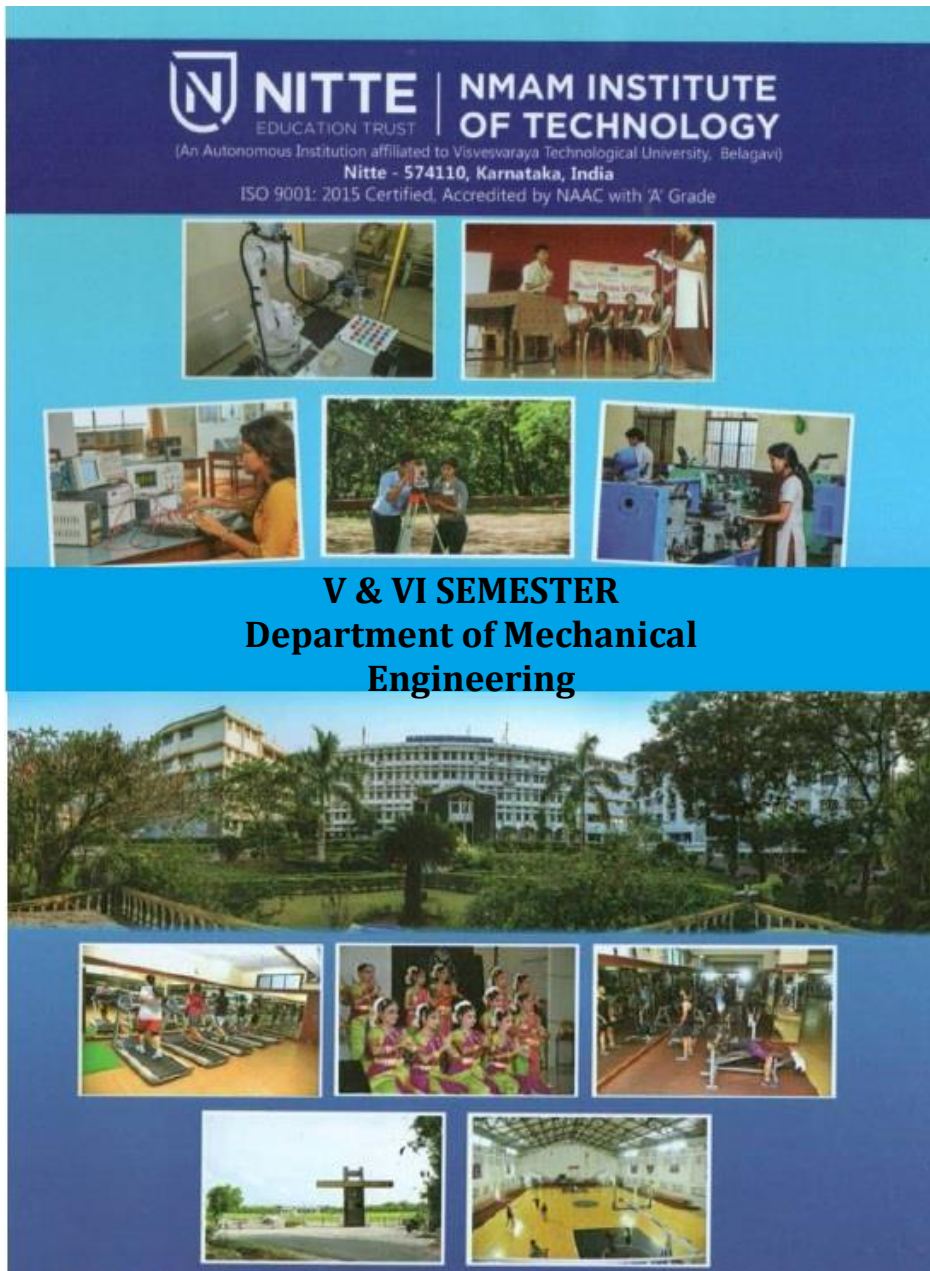


College Calendar 2023-24

Department of Mechanical Engineering



Syllabus of 3rd Year



College Calendar 2023-24

**मातेव रक्षति पितेव हिते नियुङ्क्ते
कान्तेव चापि रमयत्यपनीय खेदम् ।
लक्ष्मीं तनोति वितनोति च दिक्षु कीर्तिं
किं किं न साधयति कल्पलतेव विद्या ॥**

ಮಾತೇವ ರಕ್ಷತಿ ಪಿತೇವ ಹಿತೇ ನಿಯುಂಕ್ತೇ
ಕಾಂತೇವ ಚಾಪಿ ರಮಯತ್ಯಪನೀಯ ಖೇದಮ್ ।
ಲಕ್ಷ್ಮೀಂ ತನೋತಿ ವಿತನೋತಿ ಚ ದಿಕ್ಷು ಕೀರ್ತಿಂ
ಕಿಂ ಕಿಂ ನ ಸಾಧಯತಿ ಕಲ್ಪಲತೇವ ವಿದ್ಯಾ ॥

ತಾಯಿಯಂತೆ ರಕ್ಷಣೆಯನ್ನಿತ್ತು, ತಂದೆಯಂತೆ ಸನ್ಮಾರ್ಗದಲ್ಲಿ ತೊಡಗಿಸಿ ಪತ್ನಿಯಂತೆ ದುಃಖವನ್ನು ದೂರಮಾಡಿ ಮನಕ್ಕೆ ಮುದಕೊಡುತ್ತಾ, ಸಂಪತ್ತನ್ನು ವರ್ಧಿಸಿ ದಶದಿಕ್ಕುಗಳಲ್ಲಿ ಕೀರ್ತಿಯನ್ನು ಪಸರಿಸುವ 'ವಿದ್ಯೆ', ಕಲ್ಪಲತೆಯಂತೆ ನಾವು ಬಯಸಿದ್ದನ್ನು ಕೊಡುತ್ತಾಳೆ.

विद्या माता की तरह पालन करती है, बाप के तरह हितकर मार्ग में ही ले लेता है। पत्नी की तरह हमारा दुःख दूर करता है। मन को संतोष देता है, धन देती है, दिशाओं में कीर्ति फैलाती है। कल्पवल्ली की तरह वह सब कामनाये पूरी करती है।

Do you know in how many ways the 'Knowledge' serves his master? Like mother it protects, like father it teaches and guides, like wife, provides all kinds of happiness after destroying all sorrows, it brings wealth from every corner and spreads the fame in all direction. Like 'Kalpalatha' knowledge offers everything to human being whatever he wishes.



(An Autonomous Institution affiliated to VTU, Belgavi)
NITTE-574110, Karkala Taluk, Udupi District, Karnataka, India
ISO 9001:2015 Certified, Accredited by NAAC with "A" Grade

COLLEGE CALENDAR

2023-24

(V & VI Semester)





(An Autonomous Institution affiliated to VTU, Belgavi)
NITTE-574110, Karkala Taluk, Udupi District, Karnataka, India
ISO 9001:2015 Certified, Accredited by NAAC with “A” Grade

Vision Statement

Pursuing Excellence, Empowering people, Partnering in
CommUNIT y Development

Mission Statement

To develop N.M.A.M. Institute of Technology, Nitte, as Centre of
Excellence by imparting Quality Education to generate competent,
Skilled and Humane Manpower to face emerging Scientific,
Technological,
Managerial and Social Challenges
with Credibility, Integrity, Ethics and Social Concern.

In Memorium



Late Nitte Mahalinga Adyanthaya

Our Founder



Late Justice K. S. Hegde

1909-1990



SRI N. VINAYA HEGDE

President, Nitte Education Trust
Chancellor, Nitte (Deemed to be University), Mangaluru


**NMAM INSTITUTE
OF TECHNOLOGY**

Sl.No.	Name of the Faculty	Designation
1.	Dr. N. Niranjana Chiplunkar	Principal
2.	Mr. Yogeesh Hegde	Director(CM&D)
3.	Dr. Shrinivasa Rao B. R.	Vice Principal/Controller of Examinations/Professor
4.	Dr. I. Ramesh Mithanthaya	Vice Principal / Dean (Academic)/Professor
5.	Dr. Sudesh Bekal	Dean (R&D)/Professor
6.	Dr. Rajesh Shetty K.	Dean (Admissions)/Professor
7.	Dr. Rekha Bhandarkar	Deputy Registrar of Nitte Off-campus Centre, Nitte (DU)
8.	Dr. Subrahmanya Bhat K	Deputy COE of Nitte Off-campus Centre, Nitte (DU)
9.	Dr. Nagesh Prabhu	Director(Curriculum Development) Nitte (DU)
10.	Dr. Srinath Shetty K.	Resident Engineer/Professor
11.	Dr. Narasimha Bailkeri	Dean(Student Welfare)/Professor
12.	Dr. Rajalakshmi Samaga BL	PG Coordinator/Professor

HEADS OF DEPARTMENTS

1.	Dr. Arun Kumar Bhat	HoD, Civil Engg.
2.	Dr. Jyothi Shetty	HoD, Comp. Science & Engg
3.	Dr. Ashwini B	HoD, Information Science & Engg
4.	Dr. Ujwal P	HoD, Biotechnology
5.	Dr. KVSSSS Sairam	HoD, E&C Engg.
6.	Dr. Suryanarayana K	HoD, E&E Engg.
7.	Dr. Muralidhara	HoD, Robotics & Artificial Intelligence
8.	Dr. Kumudakshi	HoD, Mathematics
9.	Dr. Shobha R. Prabhu	HoD, Physics
10.	Dr. Shivaprasad Shetty M.	HoD, Chemistry
11.	Dr. Mamatha Balipa	HoD, MCA
12.	Dr. Vishwanatha	HoD, Humanities

13.	Dr. Udaya Kumar K Shenoy	HoD, Computer & Communication Engg
14.	Dr. Sharada Uday Shenoy	HoD, Artificial Intelligence & Machine Learning
15.	Dr. Srinivas Pai P	HoD, Mechanical Engg
16.	Dr. Venugopala PS	HoD, Artificial Intelligence & Data Science
17.	Mr. Bharath G Kumar	Head, Training & Placement Cell

INCHARGE OF INSTITUTION'S RESPONSIBILITIES

1.	Dr. Shashikanth Karinka	Co-ordinator MoUs
2.	Dr. Gururaj Upadhyaya	Workshop Suptd
3.	Dr. Joy Elvine Martis	1 st year Coordinator
4.	Dr. Jnaneshwar Pai Maroor	Co-ordinator Alumni
5.	Dr. Venkatesh Kamath	Assistant CoE
6.	Dr. Janardhan Nayak	Co-ordinator – Red Cross UNIT
7.	Mr. Srinivas Nekkar	NCC Officer
8.	Mr. Krishnaraja Joisa	Public Relation Officer
9.	Mr. K. Sathish Nayak	Digital Media Executive
10.	Sri. Shekar Poojari	Student Welfare Officer

ENTREPRENEURSHIP DEVELOPMENT CELL

1.	Dr. Ramakrishna B	Professor/EDC- Incharge
2.	Mrs. Geetha Poojarthi	Co-ordinator

DEPARTMENT OF TRAINING & PLACEMENT

1.	Mr. Ankith S Kumar	Counsellor
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DEPARTMENT OF MATHEMATICS

1.	Dr. Shashirekha B. Rai	Professor
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2.	Dr. Kumudakshi	Asso. Professor/ HoD
3.	Dr. Sharad M. Hegde	Asst. Professor Gd III
4.	Dr. Vasanth K.R	Asst. Professor Gd III
5.	Dr. Ashwini Kumari	Asst. Professor Gd III
6.	Dr. Chaithra K.	Asst. Professor Gd III
7.	Dr. Prashanthi K S	Asst. Professor Gd III
8.	Dr. Girija K P	Asst. Professor Gd III
9.	Dr. Ganesh Kumar K	Asst. Professor Gd III
10.	Mrs. Ambika N.	Asst. Professor Gd I
11.	Mrs. Vinaya Acharya	Asst. Professor Gd I
12.	Mrs. Anitha D. Bayar	Asst. Professor
13.	Mrs. Bhavya K.	Asst. Professor
14.	Mrs. Bhavya. D.	Asst. Professor
15.	Mrs. Sharmila	Asst. Professor
16.	Mrs. Anjana Pai K	Asst. Professor
17.	Mrs. Soumya	Asst. Professor
18.	Mrs. Smitha G. V.	Asst. Professor

DEPARTMENT OF PHYSICS

1.	Dr. Manjunath K. B.	Professor
2.	Dr. Shobha R. Prabhu	Asso. Professor / HoD
3.	Dr. Sathyajith	Asso. Professor
4.	Dr. Raghavendra Bairy	Asso. Professor
5.	Dr. Nagaraja B.S.	Asst. Professor Gd III
6.	Dr. Shyam Prasad . K.	Asst. Professor Gd III
7.	Dr. Saritha Suvarna	Asst. Professor Gd III

DEPARTMENT OF CHEMISTRY

1.	Dr. Janardhana Nayak	Professor
2.	Dr. Ramesh Bhat	Asso. Professor
3.	Dr. Shivaprasad Shetty M.	Asso. Prof/HoD

- | | |
|--------------------------------|------------------------|
| 4. Dr. Aarti S. Bhat | Asst. Professor Gd III |
| 5. Dr. Subrahmanya Ishwar Bhat | Asst. Professor Gd III |
| 6. Dr. Sarvajith MS | Asst. Professor Gd III |
| 7. Dr. Ranjitha | Asst. Professor Gd III |

DEPARTMENT OF HUMANITIES

- | | |
|---------------------------------|------------------------|
| 1. Dr. Ramakrishna B. | Professor |
| 2. Mrs. Rashmi D. Hegde | Asso. Professor |
| 3. Dr. Vishwanatha | Asso. Professor /HoD |
| 4. Dr. Jnaneshwar Pai Maroor | Asst. Professor Gd III |
| 5. Dr. Joy Elvine Martis | Asst. Professor Gd III |
| 6. Mrs. Shyla D Mendonca | Asst. Professor Gd II |
| 7. Ms. Sonia Lobo | Asst. Professor Gd I |
| 8. Ms. Akshatha Kumari J Shetty | Asst. Professor Gd I |
| 9. Mr. Srinivas Nekkar | Asst. Professor |
| 10. Mrs. Sudeeksha S. Pai | Asst. Professor |
| 11. Mrs. Shwetha | Asst. Professor |

OFFICE SECTION HEADS

- | | |
|----------------------------|---|
| 1. Mr. Keshava Mugeraya | Sr. Suptd, Academic Section/
Purchase In -Charge |
| 2. Mrs. Suneetha R. Shetty | Sr. Suptd, Administrative Section |
| 3. Mr. Suresh Achar | Sr. Suptd, Stores |
| 4. Mrs. Jayashree | Sr. Programmer, Office Automation Cell |
| 5. Mrs. Shailaja V. Shetty | Suptd, Accounts Section |
| 6. Dr. Preetham Shetty KV | Librarian |

SECURITY DEPARTMENT

- | | |
|---------------------------|---------------------|
| 1. Mr. Hirianna Suvarna S | Security Supervisor |
|---------------------------|---------------------|

SPORTS DEPARTMENT

- | | |
|--------------------------------|-------------------|
| 1. Sri. Shyam Sundar M. | P.E.D |
| 2. Sri. Ganesh Poojary | P.E.D |
| 3. Ms. Sowjanya M. | P.E.I |
| 4. Mr. Ravi Prakash C. Anpur | Basket Ball Coach |
| 5. Mr. Clive Nolan Mascarenhas | Football Coach |
| 6. Mr. Rajesh Acharya | Cricket Coach |

HOSTEL WARDENS

- | | |
|-----------------------|---|
| 1. Dr. Veena Devi S.V | Chief Warden, NET Ladies Hostels, Nitte |
| 2. Dr. Vishwanatha | Chief Warden, NET Gents Hostels, Nitte |

HOSTEL SUPERINTENDENT / MANAGER

- | | |
|---------------------------|-----------------------------------|
| 1. Mr. John D'Souza | Sr. Manager, Gents Main Hostel |
| 2. Mr. Manjunatha Suvarna | Hostel Manager, Gents Main Hostel |
| 3. Mr. Rajesh Ballal | Manager, Gents PG Hostel |
| 4. Mrs. Gayathri Kamath | Manager, Ladies PG Hostel |
| 5. Mrs. Chethana Sharma | Manager, Ladies Main Hostel |
| 6. Mrs. Hema S. Hegde | Superintendent, Hostel Office |

REGULATIONS

2023-24

(Applicable for admission batch 2021-22 onwards)



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**REGULATIONS COMMON TO ALL B.E. (CREDIT SYSTEM) DEGREE
PROGRAMMES OF
NMAM INSTITUTE OF TECHNOLOGY, NITTE
Karkala, Udupi Dist., Karnataka**

1. INTRODUCTION

- 1.1 The general regulations are common to all B.E. (Credit System) Degree Programmes conducted at the NMAMIT, Nitte Campus and shall be called "NMAMIT Regulations".
- 1.2 The provisions contained in this set of regulations govern the policies and procedures on the Registration of students, imparting Instructions of course, conduct of the examination and evaluation and certification of student's performance and all amendments related to the said Degree programme(s).
- 1.3 This set of Regulations, on approval by the Academic Council and Governing Council, shall supersede all the corresponding earlier sets of regulations of the BE Degree program (of VTU) along with all the amendments thereto, and shall be binding on all students undergoing the Graduate Degree Programme(s) (Credit System) conducted at the NMAMIT, Nitte with effect from its date of approval. **This set of Regulations, may evolve and get modified or changed through appropriate approvals from the Academic Council / Governing Council from time to time, and shall be binding on all stake holders (The Students, Faculty, Staff of Departments of NMAMIT, Nitte). The decision of the Academic Council/ Governing Council shall be final and binding.**
- 1.4 In order to guarantee fairness and justice to the parties concerned in view of the periodic evolutionary refinements, any specific issues or matters of concern shall be addressed separately, by the appropriate authorities, as and when found necessary.
- 1.5 The Academic Council may consider any issues or matters of Concern

relating to any or all the academic activities of NMAMIT courses for appropriate action, irrespective of whether a reference is made here in this set of Regulations or otherwise.

- 1.6 The course shall be called **Bachelor of Engineering** course abbreviated as B.E. (Subject of specialization) – Credit System.

1.7 DURATION OF THE COURSE

(a) The course shall extend over a period of total duration of 4 years.

(b) Each year shall have the following schedule with **5 ½** days a week.

Suggested Break down of Academic Year into Semesters

1. No. of Semesters / Year	Three; Two being Main semesters (odd, even) and one being a supplementary semester; after 2 main semesters. (Note: Supplementary semester is primarily to assist weak and / or failed students through make up courses. However, Autonomous Colleges may use this semester to arrange Add-On courses for other students and / or for deputing them for practical training elsewhere.)
2. Semester Duration	Main semester (odd, even) each 19 Weeks; Supplementary Semester 8 Weeks
3. Academic Activities	Main Semester

(Weeks):	Registration of Courses & Course Work (16.0) Examination Preparation and Examination (3.0) Total (19) Supplementary Semester Registration of Courses & Course Work (5.0) Examination Preparation and Examination (3.0) Total (8) Declaration of results: 2 weeks from the date of last examination Inter- Semester Recess: After each Main Semester (2) Total Vacation: 10 weeks (for those who do not register for supplementary semester) and 4 weeks (for those who register for supplementary semester)
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(Note: In each semester, there will be provision for students for Registration of courses at the beginning, dropping of courses in the middle and withdrawal from courses towards the end, under the advice of faculty member. These facilities are expected to enhance the learning capabilities of students, minimizing their chances of failure in courses registered and also ensure their better monitoring by Faculty Advisors).

A candidate shall be allowed a maximum duration of eight years from the first semester of admission to become eligible for the award of Bachelor Degree.

The calendar of events in respect of the course shall be fixed by the Senate from time to time, but preferably in line with the academic calendar of the VTU.

2. DEGREE PROGRAMMES

- 2.1 Undergraduate B.E. Degree Programmes are offered in the following disciplines by the respective programme hosting

departments listed below:

i)	Biotechnology Engineering	(BT)
ii)	Civil Engineering	(CV)
iii)	Computer Science & Engineering	(CS)
iv)	Electronics & Communications Engineering	(EC)
v)	Electrical & Electronics Engineering	(EE)
vi)	Information Science & Engineering	(IS)
vii)	Mechanical Engineering	(ME)
viii)	Artificial Intelligence and Machine Learning Engg.	(AM)
ix)	Computer and communication Engineering	(CC)
x)	Robotics and Artificial Intelligence Engineering	(RA)

Other teaching departments are –

i)	Mathematics	(MA)
ii)	Physics	(PH)
iii)	Chemistry	(CY)
iv)	Humanities, Social Sciences and Management	(HU)

- 2.2 The provisions of these Regulations shall be applicable to any new discipline* that may be introduced from time to time and appended to the above list.

3. REGISTRATION

- 3.1 Every student after consulting his Faculty Advisor in parent department shall register approved courses (core and elective) to earn credits for meeting the requirements of degree program at the commencement of each Semester on the days fixed for such registration and notified in the academic calendar. Students who fail to register on or before the specified date will have to pay a

late fee. Such courses together with their grade and credits earned will be included in the grade card issued by the college at the end of each semester, like odd, even, supplementary and it forms the basis for determining the student's performance in that semester.

3.2 Lower and Upper Limits for Course Credits Registered in a Semester

Course Credit Assignment

All courses comprise of specific Lecture/Tutorial/Practical (L-T-P) schedule. The course credits are fixed based on the following norms.

Lecture / Tutorials / Practical:

- i) One hour Lecture per week is assigned one Credit.
- ii) 2-hour Tutorial session per week is assigned 1.0 Credit.
- iii) 2-hour Lab. session per week is assigned 1.0 credit.

For example, a theory course with L-T-P schedule of 3-2-0 Hours will be assigned 4.0 credits.

A laboratory practical course with L-T-P schedule of 0-0-2 Hours will be assigned 1.0 credit.

Calculation of Contact Hours / Week – A Typical Example

A student must register, as advised by Faculty Advisor, between a minimum of 15 credits and up to a Maximum of 25 credits.

3.3 Mandatory Pre-Registration for higher semester

In order to facilitate proper planning of the academic activities of the Semester, it is necessary for the students to declare their intention to register for courses of higher semesters (3rd and above) at least two weeks before the end of the current semester choosing

the courses offered by each department in the next higher semester which is displayed on the Department Notice Board at least 4 weeks prior to the last working day of the semester.

Registration to a higher semester is allowed only if the student fulfills the following conditions -

- i) satisfied all the academic requirements to continue with the programme of studies without termination
- ii) cleared all Institute, hostel and library dues and fines, if any, of the previous semester
- iii) paid all required advance payments of the Institute and the hostel for the current semester
- iv) has not been debarred from registering on any specific grounds by the Institute.

4. **ADD / DROP / AUDIT options**

4.1 **Registration of courses**

Each student shall have to register for course work at the beginning of a semester within 2 to 3 days of commencement after discussing with subject teacher and under faculty advice. The permissible course load to be either average credits (=20) or to be within the limits of minimum (=15) and maximum (=25) credits.

4.2 **DROP-option**

During a specified period at the middle of a semester student's performance in CIE is reviewed by the faculty advisor. Following poor performance by a student he/she can be facilitated to drop identified course(s) (up to the minimum credits specified for the semester). Such course(s) will not be mentioned in the Grade card. Such courses to be re-registered by these students and taken up for study at a later time.

4.3 **Withdrawal from courses**

During a specific period specified towards the end of the semester, student's performance in CIE is reviewed by the Faculty advisors. Following poor performance by a student in identified course (s) he/she is advised to withdraw from such course(s) (up to the minimum credits specified for the semester) with mention in the Grade card (Grade 'W'). Such courses to be re-registered by these students and taken up for study at a later time.

4.4 **AUDIT-option**

A student can register for courses for audit only, with a view to supplement his/her knowledge and/or skills. The student's grades in such course(s) will have to be reflected in the grade card. However, CORE courses shall not be made available for audit. But these shall not be taken into account in determining the student's academic performance in the semester. 'U' grade is awarded to such courses on satisfying the attendance requirements and CIE requirements. The candidate need not appear for SEE in such courses.

5. **COURSE STRUCTURE:**

5.1 **Typical Breakdown for the B.E. Degree Curriculum:**

No.	Course Category	Credit Range
1.	Basic Science Courses	20-25
2.	Engineering Science Courses	18-22
3.	Humanity, Social Science and Management	8-12
4.	Ability Enhancement Courses	10-14
5.	Professional Core Courses (PCC)	40-45

6.	Professional Elective Courses (PEC)	8-12
7.	Open Elective Courses (OE)	8-12
8.	Skill Courses (Project Work / Internship / Seminar)	28-36
9.	Mandatory courses	2
Note: Student can register between 15 to 25 credits per semester Total Credits to be earned : 160		

5.2 The Department Undergraduate Committee (DUGC) will discuss and recommend the exact credits offered for the programme for the above components, the semester wise distribution among them, as well as the syllabi of all undergraduate courses offered by the department from time to time before sending the same to the Board of Studies(BOS). The BOS will consider the proposals from the departments and make recommendations to the senate for consideration and approval.

5.3 The earned Credit Requirement for the B.E. Degree is 160.

Degree is awarded by prescribing the total number of credits to be earned, rather than by using the program duration, giving flexibility to student to plan their career.

5.4 Mandatory Learning Courses

These are courses that must be completed by the student at appropriate time or at his convenience. The 'PP' grade is awarded for a Pass in the course and 'NP' grade is awarded for a Fail in the course. In case 'NP' grade is awarded, the student has to re-register for the same course wherein he has no alternative options. However, he/she can opt for other courses if he/she has been provided with multiple options.

The 'PP' and 'NP' grades do not carry grade points and hence not included in the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) computations. However such non-credit mandatory courses are required to be included in the students' performance record (transcript) with Pass or Fail (PP or NP).

Courses that come under this category are the following.

Moral and Ethical Values, Communication skills, Entrepreneurship Development Programme, Environmental issues, Proficiency in a Language etc.

Such courses will not carry any credits for the award of degree, but a pass in each of such course during the programme shall be a necessary requirement for the student to qualify for degree award.

5.5 **PROJECT**

- i) Project work at 7th semester shall be completed batch wise. The batch shall consist of a maximum of 4 students.
- ii) Project viva-voce examination shall be conducted individually.

5.6 **ELECTIVES**

- i) A candidate shall take electives in each semester from groups of electives, commencing from 6th semester.
- ii) The minimum number of students to be registered for any Elective offered shall not be less than ten.
- iii) A candidate shall opt for his/her choice of electives and register for the same if pre-registration is not done, at the beginning of each of 6th & 7th semesters. The candidate is permitted to opt for change of elective within 15 days from the date of

commencement of the semester as per the academic calendar of the college.

6. ATTENDANCE REQUIREMENT:

- 6.1 Each semester is considered as a UNIT and the candidate has to put in a minimum attendance of 85% in each subject with a provision of condoning 10% of the attendance by Principal for reasons such as medical grounds, participation in University level sports, cultural activities, seminars, workshops and paper presentation.
- 6.2 The basis for the calculation of the attendance shall be the period of term prescribed by the College by its calendar of events. For the first semester students, the same is reckoned from the date of admission to the course (as per CET/COMED-K or Management allotment).
- 6.3 The students shall be informed about their attendance position in the first week of every month by the College so that the students shall be cautioned to make up the shortage.
- 6.4 A candidate having shortage of attendance (<75%) in any course(s) registered shall not be allowed to appear for SEE of such course(s). Such students will be awarded 'N' grade in these courses.

He/she shall have to repeat those course(s). Such students shall re-register for the same course(s) core or elective, as the case may be when the particular course is offered next either in a main (odd/even) or supplementary semester.

- 6.5 **Attendance in CIE and SEE:** Attendance at all examinations both CIE and SEE of each course registered shall be compulsory and there shall not be any provision for re-examinations. Any student against whom any disciplinary action is pending shall not be permitted to attend any SEE in that semester.

7. WITHDRAWAL FROM THE PROGRAMME

7.1 Temporary Withdrawal

- a) A student who has been admitted to a degree programme of the college may be permitted once during the course to withdraw temporarily, for a period of one semester, on the grounds of prolonged illness or grave calamity in the family etc., provided –
- i) The student applies to the College within 6 weeks of the commencement of the college stating fully the reasons for withdrawal together with supporting documents and endorsement from his parent/guardian.
 - ii) The College is satisfied about the genuineness of the case and that even by taking into account the expected period of withdrawal, the student has the possibility to complete the programme requirements (160 credits) within the time limits specified by the university.
 - iii) The student does not have any dues or demands at the College / University including tuition and other fees as well as library material.
 - iv) A student availing of temporary withdrawal shall be required to pay such fees and/or charges as may be fixed by the college until such time as his/her name appears on the Student's roll list. The fees/charges once paid shall not be refunded.
 - v) A student will be entitled to avail the temporary withdrawal facility only once during his/her studentship. However, any other concession for the concerned student shall have to be approved by the academic council.

7.2 Permanent Withdrawal

Any student who withdraws admission before the closing date of

admission for the Academic Session is eligible for the refund of the deposits only. Fees once paid will not be refunded on any account.

Once the admission for the year is closed, the following conditions govern withdrawal of admissions.

- (a) A student who wants to leave the College for good, will be permitted to do so (and take Transfer Certificate from the College, if needed), only after remitting the Tuition fees as applicable for all the remaining semesters and clearing all other dues if any.
- (b) Those students who have received any scholarship, stipend or other forms of assistance from the College shall repay all such amounts.
- (c) The decision of the Principal of the College regarding withdrawal of a student is final and binding.

8. **EVALUATION SYSTEM**

- 8.1 The Academic Performance Evaluation of a student shall be according to a Letter Grading System, based on the Class Performance Distribution.
- 8.2 The Letter grades S, A, B, C, D, E, F indicate the level of academic achievement, assessed on a decimal (0-10) scale.
- 8.3 The Letter grade awarded to a student in a course, for which he has registered shall be based on his performance in quizzes, tutorials, assignments etc., as applicable, in addition to two mid-semester examinations and one semester end examination. The distribution of weightage among these components may be as

follows.

- Semester End Examination (SEE) : 50% (50 marks)
 Continuous Internal Evaluation (CIE) : 50% (50 marks)
- i) Quizzes, Tutorials, Assignments,
 Seminars, mini projects, tutorials etc. : 10 marks
 - ii) Mid-semester Examination : 40 marks

Any variation, other than the above distribution, requires the approval of the pertinent DUGC and Academic Council.

- 8.4 The letter grade awarded to a student in a 0-0-P (Practical) course, is based on an appropriate continuous evaluation scheme that the course instructor shall evolve, with the approval of the pertinent DUGC and the performance in SEE held on specified period in a semester.
- 8.5 The course Instructor shall announce in the class and/or display at the faculty door/website the details of the Evaluation Scheme, including the distribution of the weightage for each of the components and method of conversion from the raw scores to the letter-grades within the first week of the semester in which the course is offered, so that there are no ambiguities in communicating the same to all the students concerned.

8.6 **Passing standards**

Evaluation Method	Passing Standard
Sessional (CIE)	Score: $\geq 40\%$ (≥ 20 marks)
Terminal (SEE)	Score: $\geq 40\%$ (≥ 20 marks)

- i) Project work evaluation: The evaluation of CIE of the project work shall be based on the progress of the student in the work assigned by the project supervisor, periodically evaluated

by him/her together with a Department committee constituted for this purpose. Seminar presentation, project report and final oral examination conducted by project evaluation committee at the department level shall form the SEE of the project work.

- ii) In the case of other requirements, such as, seminar, industrial internship, field work, comprehensive viva voce, if any, the assessment shall be made as laid down by the Academic council.
- iii) **There shall be no re-examination for any course in the credit system.**

However, students

- who have abstained from attending CIE or SEE without valid reasons ('N' grade), or
- who have failed ('F' grade) to meet the minimum passing standards prescribed for CIE and/or SEE, or
- who have been detained for want of attendance, or
- who have withdrawn ('W' grade),
- who have dropped any course

shall be required to re-register for such course(s) and go through CIE and SEE again and obtain a grade equal to or better than E in each case. While such students should re-register for same course(s) if core, they can re-register for alternative course(s) from among the elective courses, as the case may be. The re- registration shall be possible when the particular course is offered again either in a main (Odd/Even) or a supplementary semester.

8.7

i) Grade point scale for absolute grading

Level	Out Standing	Excellent	Very Good	Good	Average	Poor	Fail
Grade	S	A	B	C	D	E	F
Grade Points	10	09	08	07	06	04	00
Score (Marks) Range(%)	≥ 90	$< 90 - \geq 80$	$< 80 - \geq 70$	$< 70 - \geq 60$	$< 60 - \geq 50$	$< 50 - \geq 40$	< 40

- ii)** The grade points given above help in the evaluation of credit points earned by the student in a course as the credit points are equal to the number of credits assigned to the course multiplied by the grade points awarded to the student in that course. This shall be used in arriving at the credit index of the student for that semester, as it is the sum total of all the credit points earned by the student for all the courses registered in that semester.

8.8 Earning of Credits

A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range S-E. Letter grade 'F' in any course implies failure of the student in that course and no credits earned.

- 8.9** The Transitional Grades 'I', 'W' and 'X' would be awarded by the teachers in the following cases. These would be converted into one or the other of the letter grades (S-F) after the student completes the course requirements.

- i. Grade 'I': To a student having satisfactory attendance at classes and meeting the passing standard at CIE, but remained absent from SEE for valid & convincing reasons acceptable to the College, like:
 - i) Illness or accident, which disabled him/her from attending SEE;
 - ii) A calamity in the family at the time of SEE, which required the student to be away from the College;
1. Students who remain absent for Semester End Examinations due to valid reasons and those who are absent due to health reasons are required to submit the necessary documents along with their request to the Controller of Examinations to write Make up Examinations within 2 working days of that particular examination for which he or she is absent, failing which they will not be given permission. This is admissible only for students who have more than 45 CIE marks.
2. Grade 'W': To a student having satisfactory attendance at classes, but withdrawing from that course before the prescribed date in a semester under Faculty Advice
3. Grade 'X': To a student having attendance $\geq 85\%$ and CIE rating (90%), in a course but SEE performance observed to be poor, which could result in a F grade in the course. **(No 'F' grade awarded in this case but student's performance record maintained separately).**

b. Grade Card

Each student shall be issued a Grade Card at the end of each semester. This will have a list of all the courses registered by a student in the semester, together with their credits, the letter grades with grade points awarded. Only those courses registered for credit and having grade points shall be included in the computation of the students performance like SGPA and CGPA and the courses taken for audit will not form part of this computation.

The results of mandatory courses, which are of the non-credit type shall also be reflected in the Grade card as PP (for Passed) or NP (for not passed). **Each UG student shall have to obtain the grade PP in each mandatory course to qualify for the Degree awarded by the university.**

C. The Make Up Examination

The Make Up Examination facility would be available to students who may have missed to attend the SEE of one or more course(s) in a semester for valid reasons and given the 'I' grade; Also, students having the 'X' grade shall be eligible to take advantage of this facility. The makeup examination would be held as per dates notified in the Academic Calendar. However, it would be possible to hold a makeup examination at any other time in the semester with the permission of the Academic Council of the College. In all these cases, the standard of makeup examinations shall be same as the regular SEE for the course(s).

- a) All the 'I' and 'X' grades awarded to the students would be converted to appropriate letter grades after the make-up examinations. Any outstanding 'I' and 'X' grades after the last scheduled make-up examinations shall be automatically converted to 'F' grade.
- b) All the 'W' grades awarded to the students would be eligible for conversion to the appropriate letter grades only after the concerned students re-register for these courses in a main/supplementary semester and fulfill the passing standards for their CIE and (CIE+SEE).

9. EVALUATION OF PERFORMANCE

The overall performance of a student will be indicated by two

indices:

SGPA; which is the Semester Grade Point Average, and CGPA which is the Cumulative Grade Point Average.

SGPA for a semester is computed as follows.

$$\text{SGPA} = \frac{\sum [(\text{course credit}) \times (\text{Grade point})] \text{ (for all courses in that semester)}}{\sum [(\text{course credits})]}$$

CGPA is computed as follows:

$$\text{CGPA} = \frac{\sum [(\text{course credits}) \times (\text{Grade points})] \text{ (for all courses excluding those with F grades until that semester)}}{\sum (\text{course credits})] \text{ (for all courses excluding those with F grades until that semester)}}$$

10. **COMMUNICATION OF GRADES**

The SGPA and CGPA respectively, facilitate the declaration of academic performance of a student at the end of a semester and at the end of successive semesters. Both of them would be normally calculated to the second decimal position.

11. **VERTICAL PROGRESSION (PROMOTION / ELIGIBILITY TO HIGHER SEMESTERS)**

11.1 There shall be no restriction for promotion from an odd semester to the next even semester, provided the student has fulfilled the attendance requirement.

11.2 **A Student shall be declared fail if he / she**

- (i) Has not satisfied the CIE requirements of any Course/s.

- (ii) Has not registered for the SEE even after satisfying the attendance and CIE requirements.

11.3 (A) Vertical Progression in case of students admitted to First year:

- (a) Students having not more than four F grades in the two semesters of first year of the Programme shall be eligible to move to second year.
- (a.1) Students having not more than four F grades in the four semesters of I and II year shall be eligible to move to III year.
- (a.2) Students who have earned all the prescribed credits of I year, and having not more than four grades in the four semesters of II and III year shall be eligible to move to IV year.

(B) Vertical Progression in case of Diploma students admitted to Second year (lateral entry):

- (a) Students having not more than four F grades (excluding the Fail or pass status of Additional Mathematics I and II) in the two semesters of II year of the Programme shall be eligible to move to III Year.
- (a.1) Students having not more than four F grades (excluding the Fail or pass status of Additional Mathematics I and II, if any) in the four semesters of II and III year shall be eligible to move to IV year.
- (b) The mandatory non-credit Courses Additional Mathematics I and II prescribed at III and IV semesters respectively, to lateral entry Diploma holders admitted to III semester of B.E/B.Tech. Programmes shall attend the classes during the respective semesters to satisfy attendance and CIE requirements and to appear for the University examinations.
- (b.1) In case, any student fails to satisfy the attendance requirement of the Courses Additional Mathematics I and II, he/she shall not be eligible to appear for the Semester End Examinations of that semester and shall not be permitted to take admission to next higher semester. The candidate shall be required to repeat that semester during the subsequent year.
- (b.2) Students who have satisfied the attendance requirement but not the CIE requirements of the Courses Additional Mathematics I and II shall be permitted to register afresh and appear for SEE after satisfying the CIE requirements in the same Course/s (with or without satisfying the attendance requirement) when offered during subsequent semester/s.

- (c) Completion of Additional Mathematics I and II shall be mandatory for the award of degree.

(C) Vertical Progression in case of B.Sc students admitted to Second year (Lateral entry):

- (a) Students having not more than four F grades (excluding the Fail or pass status of Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme) in the two semesters of II year of the Programme shall be eligible to move to III year.
 - (a.1) Students having not more than four F grades (excluding the Fail or pass status of Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme, if any) in the four semesters of II and III year shall be eligible to move to IV year.
- (b) The prescribed mandatory non-credit Courses Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme to lateral entry B. Sc holders admitted to III semester of B.E/B. Tech Programmes, shall attend the classes during the respective semesters to complete CIE and attendance requirements and to appear for the University examinations.
 - (b.1) In case, any student fails to satisfy the attendance requirement of the above said Courses; he/she shall not be eligible to appear for the Semester End Examinations of that semester and shall not be permitted to take admission to next higher semester. The candidate shall be required to repeat that semester during the subsequent year.
 - (b.2) Students who have satisfied the attendance requirement but not the CIE requirements of the above said Courses, shall be permitted to register afresh and appear for SEE after satisfying the CIE requirements in the same Course/s (with or without satisfying the attendance requirement) when offered during subsequent semester/s.
- (c) Completion of Engineering Graphics and Elements of Civil Engineering and Mechanics shall be mandatory for the award of degree.

The Principal of each college shall make suitable arrangements in the timetable to facilitate the B. Sc students to attend the above mentioned courses to satisfy the CIE and attendance requirements and to appear for the University examinations.

11.4 Termination from the programme

A student shall be required to withdraw (discontinue) from the programme and leave the college on the following grounds.

- i) **Failure to secure a CGPA = 5.0 on three consecutive occasions.**
- ii) **Failure to earn a credit of 160 (120 for lateral entry students) in 8 years (6 years for lateral entry students) of duration from the year of admission including the duration of temporary withdrawal (leave of absence).**
- iii) Absence from classes for more than **six weeks at a time** in a semester without leave of absence being granted by competent authorities.
- iv) Failure to meet the standards of discipline as prescribed by the college from time to time.

12. AWARD OF CLASS

Sometimes, it would be necessary to provide equivalence of these averages, viz., SGPA and CGPA with the percentages and/or Class awarded as in the conventional system of declaring the results of University examinations. This can be done by prescribing certain specific thresholds in these averages for Distinction, First Class and Second Class. This can be seen from the following Table.

Percentage Equivalence of Grade Points (For a 10-Point Scale)

Grade Point	Percentage of Marks	Class
≥ 7.75	$\geq 70\%$	Distinction
≥ 6.75	$\geq 60\%$	First Class
< 6.75	$< 60\%$	Second Class

$$\text{Percentage} = (\text{GPA} - 0.75) \times 10$$

13. APPEAL FOR REVIEW OF GRADES

- a. The entire process of evaluation shall be made transparent and the course instructor shall explain to a student why he/she gets whatever grade he/she is awarded, if and when

required. A mechanism for review of grade is incorporated in the evaluation system. However, before appealing for such review, a student shall first approach the concerned course Instructor and then the concerned DUGC, with the request to do the needful; and only in situations where satisfactory remedial measures have not been taken, the student may then appeal to the Department Academic Appeals Boards (DAAB) before the date specified in Academic Calendar, by paying the prescribed fees.

- b. The fee for such an appeal will be decided by the Senate from time to time. If the appeal is upheld by DAAB, then the fee amount will be refunded to the student.

14. AWARD OF DEGREE

14.1 (1) B.E. Degree

- a) Students shall be declared to have completed the Programme of B.E./B.Tech. degree and is eligible for the award of degree, provided the students have undergone the stipulated Course work of all the semesters under the Scheme of Teaching and Examinations and has earned the prescribed number of credits (160 credits for regular students registered for 4 year degree programmes & 120 for lateral entry students).
- b) For the award of degree, a CGPA ≥ 5.00 at the end of Programme shall be mandatory.
- c) Completion of Additional Mathematics I and II, shall be mandatory for the award of degree to lateral entry diploma students.
- d) Completion of Engineering Graphics and Elements of Civil Engineering and Mechanics of First Year Engineering Programme shall be mandatory for the award of degree to lateral entry B.Sc. graduates.
- e) (i) Over and above the academic credits, every Day College regular student admitted to the 4 years Degree Programme and every student entering 4 years Degree Programme through lateral entry, shall earn 100 and 75 Activity Points respectively through AICTE Activity Point Programme for the award of degree. Students transferred from other Universities/Autonomous colleges under VTU

to fifth semester are required to earn 50 Activity Points from the year of entry to VTU. The Activity Points earned shall be reflected on the student's eight semester Grade Card.

(ii) Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

In case students fail to earn the prescribed activity Points before the commencement of 8th semester examinations, eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

(2) B.E. (Honors) Degree

VTU, Belagavi has framed the guidelines for applying for the award of Bachelor of Engineering (Honors) degree.

These Regulations are applicable for the following students:

1. Admitted to **I semester** / I year from the academic year **2018-19** (i.e. USN XXX18XXXXX)
2. Admitted to **III semester** / II year from the academic year **2019-20** (i.e. USN XXX19XX4XX)
3. These Regulations are uniformly applicable to Affiliated, Autonomous and Constituent Colleges under VTU.

Eligibility criterion

- (i) Students have to earn 18 or more additional credits through MOOCs.
- (ii) Students shall register for this course from fifth semester onwards.
- (iii) Students shall obtain a grade \geq D in all the courses in first attempt only in all the semesters till 5th.
- (iv) Students shall obtain CGPA of 8.5 and above at the end of fourth semester.
- (v) For Diploma students, they shall complete Additional Mathematics I and II during 3rd and 4th semesters in first attempt only.

Requirements:

- (i) Students shall maintain a grade $\geq D$ in all courses from 5th to 8th semester in 'first attempt' only.
- (ii) Students not having CGPA greater than or equal to 8.5 at the end of the B.E. programme shall not be eligible for the award of Honors degree, even if they have satisfied the requirement of additional credits.
- (iii) Students shall take up additional course work, other than the regular courses prescribed by the University from 5th to 8th semester from NPTEL and other platforms notified by the University and complete the same in any number of attempts with a final score (online assignments: 25 % + Proctored examination: 75 %) leading to the following certificates – ELITE (60 to 75 %) or ELITE + SILVER (76 to 89 %) or ELITE + GOLD (≥ 90 %) before closure of eighth semester as per the academic calendar.
- (iv) Students shall be permitted to drop the registered course work (s) and select alternative course work (s) in case they cannot give proctored examination.
- (v) Students have to take courses from the list of MOOCs approved by the University, which can be from NPTEL / SWAYAM / other platforms.
- (vi) Students shall select courses in consultation with their Class Advisor, such that the content / syllabus of them are not similar to that of the core courses, professional electives or open electives, which the students may chose in the program.
- (vii) Students shall earn the additional credits for these courses through MOOCs, by only appearing in person to the proctored examinations conducted by NPTEL / SWAYAM / other platform. The method of assessment shall be as per NPTEL online platform.
- (viii) The Credit equivalence shall be as follows - 4 weeks of online course duration – 1 credit, 8 weeks of online course duration – 2 credits and 12 weeks of online course duration – 3 credits.

Registration:

- (i) Any student meeting the eligibility criteria and interested to register for Honors degree qualification shall apply to the University through the Principal in the prescribed form along with the prescribed application fees within 15 working days after notification by the University.

- (ii) The Registrar shall notify the registration of the student and it will be notified to the student and the student shall pay a one-time, non-refundable registration fees as prescribed by the University to confirm the registration.

Award of Honors Qualification:

- (i) Students who successfully complete the MOOCs prescribed by the University and submit their E-certificates to the University through the Principal against the notification issued by the Registrar in time before the closure of eighth semester, as per the academic calendar shall be eligible for B.E. (Honors) degree. If a student does not submit the certificates in time on or before the last date, their request shall not be considered, even if they have earned the requisite number of credits.
- (ii) The Honors degree shall be awarded only if the CGPA at the end of the B.E. programme is equal to or greater than 8.5.
- (iii) A student who has earned the requisite number of credits and who has submitted the certificates in time and has been accepted by the University will get B.E. degree with Honors suffixed indicating recognition of higher achievement by the student concerned.
- (iv) Further students fulfilling all the above requirements shall be entitled to receive their transcripts indicating both the achievement of the student concerned.
- (v) The award of the Honors degree shall be recommended by the Academic Senate and approved by the Executive Council of the University.

14.2 (1) Noncompliance of CGPA \geq 5.00 at the end of the Programme

- (a) Students, who have completed all the courses of the Programme but not having a CGPA \geq 5.00 at the end of the Programme, shall not be eligible for the award of the degree.
- (b) In the cases of 14.2 (1) a, students shall be permitted to appear again for SEE in course/s (other than Internship, Technical seminar, Project (Mini and Main), and Laboratories) of any Semester/s without the rejection of CIE marks for any number of times, subject to the provision of maximum duration of the Programme to make up the CGPA equal to or greater than 5.00 for the award of the Degree.

- (c) In case, the students earn improved grade/s in all the reappeared course/s, the CGPA shall be calculated considering the improved grade/s. If it is ≥ 5.00 , the students shall become eligible for the award of the degree. If $CGPA < 5.00$, the students shall follow the procedure laid in 14.2 (1) b
- (d) In case, the students earn improved grade/s in some course/s and the same or lesser than the previously earned pass grade/s in the other reappeared course/s, the CGPA shall be calculated considering the improved grade/s and the pass grades earned before the reappearance. If it is ≥ 5.00 , the students shall become eligible for the award of the degree. If $CGPA < 5.00$, the students shall follow the procedure laid in 14.2 (1) b
- (e) In case, the students earn improved grade/s in some courses and fail in the other reappeared course/s, the CGPA shall be calculated by considering the improved grade/s and the previously earned pass grade/s of the reappeared course/s in which the students have failed. If it is ≥ 5.00 , the students shall become eligible for the award of the degree. If $CGPA < 5.00$, the students shall follow the procedure laid in 14.2 (1) b
- (f) In case, the students fail (i.e., earns F grade) in all the reappeared course/s, pass grade/s of the course/s earned by the students before reappearance shall be retained. In such cases, the students shall follow the procedure laid in 14.2 (1) b
- (g) Students shall obtain written permission from the Registrar (Evaluation) to reappear in SEE to make up the CGPA equal to or greater than 5.00.

(2) Noncompliance of Mini-project

- (a) The mini-project shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the mini-project shall be declared fail in that course and shall have to complete the same during subsequent University examinations after satisfying the Mini-project requirements. Also, mini-project shall be considered for eligibility to VII semester.

(3) Noncompliance of Internship

- (a) All the students of B.E/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation. A University examination shall be conducted during VIII semester. Internship shall be considered as a head of passing and

shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail in that Course and shall have to complete the same during subsequent University examinations after satisfy the internship requirements.

14.3 The maximum duration for a student for complying to the Degree requirements is 16 – semesters from the date of first registration for his first semester (8 years from the date of admission to first year, (12 semesters / 6 years from the date of admission for lateral entry student)).

15 GRADUATION REQUIREMENTS AND CONVOCATION

15.1 A student shall be declared to be eligible for the award of the degree if he/she has

- a) **Fulfilled “Award of Degree” Requirements**
- b) **No Dues to the College, Departments, Hostels, Library, Central Computer Centre and any other centres**
- c) **No disciplinary action pending against him/her.**

15.2 The award of the degree must be recommended by the Senate

15.3 Convocation

Degree will be awarded for the students who have graduated during the preceding academic year. Students are required to apply for the Convocation along with the prescribed fees, after having satisfactorily completed all the degree requirements (refer ‘Award of Degree’) within the specified date in order to arrange for the award of the degree during convocation.

16 AWARD OF PRIZES, MEDALS, CLASS & RANKS

For the award of Prizes and Medals, the conditions stipulated by the Donor may be considered as per the statutes framed by the

College for such awards.

Sometimes, it would be necessary to provide equivalence of these averages, viz., SGPA and CGPA with the percentages and/or Class awarded as in the conventional system of declaring the results of University examinations. This can be done by prescribing certain specific thresholds in these averages for Distinction, First Class and Second Class as described in 12.

17 CONDUCT AND DISCIPLINE

- 17.1 Students shall conduct themselves within and outside the premises of the College in a manner befitting the students of an Institution of National Importance.
- 17.2 As per the order of Honorable Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.
- 17.3 The following acts of omission/ or commission shall constitute gross violation of the Code of Conduct and are liable to invoke disciplinary measures:
 - a) Ragging.
 - b) Lack of courtesy and decorum; indecent behaviour anywhere within or outside the campus.
 - c) Willful damage or stealthy removal of any property/belongings of the College/Hostel or of fellow students/citizens.
 - d) Possession, consumption or distribution of alcoholic drinks or any kind of hallucinogenic drugs.
 - e) Mutilation or unauthorized possession of Library books.
 - f) Noisy and unseemly behaviour, disturbing studies of fellow students.
 - g) Hacking in computer systems (such as entering into other Person's area without prior permission, manipulation and/or Damage of computer hardware and software or any other

Cyber crime etc.).

- h) Plagiarism of any nature.
- i) Any other act of gross indiscipline as decided by the Senate from time to time.
- j) Use of Mobile in the college Academic area.
- k) Smoking in College Campus and supari chewing.
- l) Unauthorized fund raising and promoting sales.

Commensurate with the gravity of offence the punishment may be: reprimand, expulsion from the hostel, debarring from an examination, disallowing the use of certain facilities of the College, rustication for a specified period or even outright expulsion from the College, or even handing over the case to appropriate law enforcement authorities or the judiciary, as required by the circumstances.

- 17.4 For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the Chief Warden, the Head of the Department and the Dean (Academics), respectively, shall have the authority to reprimand or impose fine.
- 17.5 All cases involving punishment other than reprimand shall be reported to the Principal.
- 17.6 Cases of adoption of unfair means and/or any malpractice in an examination shall be reported to the Controller of Examinations for taking appropriate action.


18. EARNING OF ACTIVITY POINTS FOR THE AWARD OF DEGREE

- 18.1 As per VTU guidelines, every students entering 4 year degree programme should earn 100 activity points & every students entering 4 year degree programme through Lateral Entry should earn 75 activity points for the award of the Engineering Degree.

- 18.2 The Activity Points earned will be reflected on the student's eighth semester Grade Card.
- 18.3 The activities can be spread over the years (duration of the programme) any time during the semester weekends and holidays, as per the interest & convenience of the students from the year of entry to the programme.
- 18.4 Activity Points (non-credit) have no effect on SGPA/CGPA point.
- 18.5 In case students fail to earn the prescribed Activity Points, Eighth semester Grade Card shall be issued only after earning the required Activity Points.

Note: Students are required to be inside the examination hall 20 minutes before the commencement of examination. This is applicable for all examinations (Semester end/Supplementary/makeup) henceforth. Students will not be allowed inside the examination hall after the commencement, under any circumstances.

LIST OF MAJOR SCHOLARSHIPS

<i>Applicable to</i>	<i>Types of scholarship</i>	<i>Method</i>	<i>Website</i>
<i>For SC/ST Students</i>	<i>Income : Below Rs.2,50,000/-</i>	<i>Online application</i>	 SSP
	<i>Income : Above Rs.2,50,000/- to Rs.10,00,000/-</i>		
<i>For Others</i>	<i>Category I : Income Below Rs.2,50,000/-</i>	<i>Online application</i>	
	<i>Category 2A, 3A, 3B Income Below Rs.1,00,000/-</i>	<i>Online application</i>	
	<i>GSB & Brahmins EWS Certificate upto Rs.8,00,000/-</i>	<i>Online application</i>	
	<i>Minority students Income Below Rs.2,50,000/-</i>	<i>Online application</i>	<i>NSP & SSP</i>
<i>Parents must have Beedi Id. Card</i>	<i>Beedi Scholarship</i>	<i>Online application</i>	<i>scholarships.gov.in or nsp.gov.in</i>

- Scholarship details will be published in the notice board near College Academic Section. Students must see the notice board and submit the application before due dates.
- All SC/ST and Category I students who have not paid any fee in CET must apply for Fee concession or Scholarship. Otherwise they must pay the tuition fee and college fee.
- The students, who are applying for any of the above scholarship through online, must submit the hardcopy with supporting documents (with attestation) to the academic section in time.

B. E. SYLLABUS

ENGINEERING

V & VI SEMESTER

**With
Scheme of Teaching
& Examination**

Visvesvaraya Technological University, Belagavi B.E.in Mechanical Engineering Scheme of Teaching and Examinations 2021 Outcome Based Education(OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2021-22)													
V SEMESTER													
Sl .No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week				Examination				Credit
					Theory Lecture	Tutorial	Practical / Drawing	Self Study	Duration In Hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	21ME501	Theory of Machines	ME	2	2	0	0	3	50	50	100	3
2	IPCC	21ME502	Mechatronics	ME	3	0	2	0	3	50	50	100	4
3	PCC	21ME503	Engineering Economics	ME	3	0	0	0	3	50	50	100	3
4	PCC	21ME504	Automotive Engineering	ME	3	0	0	0	3	50	50	100	3
5	PCC	21ME505	Energy Conversion Lab	ME	0	0	2	0	3	50	50	100	1
6	AEC	21HU511	Research Methodology & Intellectual Property Rights	Any Dept.	2	0	0	0	2	50	50	100	2
8	HSMC	21CV512	Environmental Studies	Civil/ Environmental Chemistry /Biotech [Paper setting: Civil Engineering Board]	1	0	0	0	1	50	50	100	1
9	AEC	21MEA5X	Ability Enhancement Course-V		1	0	0	0	1	50	50	100	1
TOTAL									21	400	400	800	18
Note: BSC: Basic Science Course, PCC: Professional Core Course, HSMC: Humanity and Social Science & Management Courses, AEC –Ability Enhancement Courses. INT –Internship, IPCC: Integrated Professional Core Course.													

<p>L–Lecture,T–Tutorial,P-Practical/Drawing,S–SelfStudyComponent,CIE:ContinuousInternalEvaluation,SEE:SemesterEndExamination</p>
<ol style="list-style-type: none"> 1. The mandatory non – credit courses Physical Education (Sport and Athletics), Yoga and NSS I and II prescribed for V and VI semesters respectively, to the students admitted to V semester of B.E./B.Tech., programs, shall attend corresponding the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/fails to secure the minimum of 40%ofthe prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for SEE. 2. These Courses shall not be consideredforverticalprogression,butcompletionofthecourse shallbemandatoryfortheawardofdegree. 3. The students who take a course on Physical education he/she has to take up the semester-end practical examination prescribed for 100 marks. The students who opt for the NSS course have to submit reports and attend to viva-voce examination. The marks for the report shall be 50 marks and for presentation and viva-voce 50 marks.
<p>Integrated Professional Core Course (IPCC): It refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 considering L:T:P as 3:0:2 or L:T:P as 2:2:2. For an IPCC, the theory part shall be evaluated by both CIE and SEE, and the practical part is evaluated by CIE only (there shall be no semester-end examination (SEE) for the practical part). For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.</p>

Visvesvaraya Technological University, Belagavi B.E.in
Mechanical Engineering Scheme of Teaching and
Examinations 2021
Outcome-Based Education(OBE)and Choice Based Credit System(CBCS)
(Effective from the academic year 2021-22)

VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical /Drawing	Self Study	D u r a t i o n	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMC	21ME601	Operations Management and Entrepreneurship	ME/IPE	3	0	0	0	3	50	50	100	3
2	IPCC	21ME602	Heat Transfer	ME	2	2	2	0	3	50	50	100	4
3	PCC	21ME603	Design of Machine Elements	ME	2	2	0	0	3	50	50	100	3
4	PEC	21MEEXX	Professional Elective Course-I (Group-1)	ME	3	0	0	0	3	50	50	100	3
5	OEC	21ME8XY	Open Elective Course-I	ME	3	0	0	0	3	50	50	100	3
6	PCC	21ME604	CAMA Lab	ME	0	0	2	0	3	50	50	100	1
7	MP	21ME605	Mini Project	ME				0	3	100		100	2
8	INT	21INT61	Innovation / Entrepreneurship / Social based Internship (4 weeks)	Completed during the vacation of IV and V semesters					3	100	--	100	3
TOTAL									22	400	400	800	22

Note: BSC: Basic Science Course, PCC: Professional Core Course, HSMC: Humanity and Social Science & Management Courses, PEC: Professional Elective Courses, OEC –Open Elective Course, AEC –Ability Enhancement Courses. MP –Mini Project, IPCC: Integrated Professional Core Course

L–Lecture,T–Tutorial,P–Practical/Drawing,S–SelfStudyComponent,CIE:ContinuousInternalEvaluation,SEE:SemesterEndExamination

4. The mandatory non – credit courses Physical Education (Sport and Athletics), Yoga and NSS I and II prescribed for V and VI semesters respectively, to the students admitted to V semester of B.E./B.Tech., programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the student has to fulfill the requirements During subsequent semester/s to appear for SEE.

5. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

1. The students who take course on Physical education he has to take up practical examination for SEE. The students who take NSS course have to submit report, for SEE has to present(PPT) and answer vivo-voce for marks in the ratio 50:50

Research/Industrial Internship (21INT82)– At the End of the sixth / Seventh semester (in two cycles to accommodate all the students of the University)Research/Industrial Internship shall be carried out – Based on industrial/ Govt./ NGO/ MSME/ Rural Internship/ Innovation/ Entrepreneurship. All the students admitted shall have to undergo a mandatory internship of **24weeks** during the vacation of VI/VII semesters. A University Viva-Voce examination shall be conducted during VII/VIII semester and the prescribed credit shall be included in VII/VIII semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to Complete during subsequent University examination after satisfying the internship requirements.

Research internship Students have to take up research internships at Centers of Excellence (CoE)/ Study Centers established in the same institute and / or out of the institute at reputed research organizations / Institutes. A research internship is intended to give you the flavor of current research going on in a particular topic/s. This helps students get familiarized with the field, the skill needed the effort amount and kind of effort required for carrying out research in that field.

Industry internships: Is an extended period of work experience undertaken by students looking to supplement their degree with professional development. The students are allowed to prepare themselves for the workplace and develop practical skills as well as academic ones. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering knowledge with practical constraints.

The student can take up Interdisciplinary Industry Internship. Students can undergo industry internships in recognized industries from local/within the state/within the country/abroad within the stipulated time as mentioned in the scheme The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship. University shall not bear any expenses incurred in respect of internship.

Mini-project work: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini-project can be assigned to an individual student or to a group having not more than 4 students. (or Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications) CIE procedure for Mini-project:

- (i) **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25.**The marks awarded for the project report shall be the same for all the batchmates.**
- (ii) **Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the of ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

SEE for Mini-project:

- (i) **Single discipline:** Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester-end examination (SEE) conducted at the department.
- (ii) **Interdisciplinary:** Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester-end examination(SEE)conductedseparatelyatthedepartmentstowhichthestudent/s belongs.

Professional Elective Courses(PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of the educational experience in the selected stream of the Engineering & Technology curriculum. Multidisciplinary courses that supplement the programs have been added as elective courses. These courses deal with the latest trend and advanced technology in the selected stream of engineering. Three groups of PEC are made available for undergraduate students in the curriculum. Each group will provide an option to select one out of four to five. Each group of Professional Elective Courses contains all stream courses, which will help the students to select and study particular stream course of his interest. (Courses which are common to AU, ME, IP Board should have the same code) Similarly for (CSE, ISE, MCA) and (CV, Arch, Mining) and (EEE, ECE, EIE,) and (CH, SX, TX).

The minimum students' strength for offering professional electives is 05, if the strength is less than the 05 then the college has to take the permission to offer the course.

Professional Elective Courses may be Integrated course shaving both Theory and Practical syllabus, However total credits for the course shall remain (L:T:P = 2:0:2)/(L:T:P = 1:2:2)= 03 only.

Integrated Professional Core Course (IPCC): It refers to Professional Theory Core Course Integrated with Practical's of the same course. Credit for IPCC can be 04 considering L:T:P as 3:0:2 or L:T:P as 2:2:2. For an IPCC, theory part shall be evaluated by both CIE and SEE and practical part be evaluated by CIE only (there shall be no semester end examination (SEE) for the practical part). For more details the regulation governing the Degree of Bachelor of Engineering /Technology (BE/ B.Tech) 2021-22 may be referred.

Open Elective Courses:

All Open Electives are offered to students of all branches in general. However, a student shall choose an open Elective from the list in such a manner that he/she has not studied the same course in any form during the Program. Students can select anyone of the open electives offered by other Departments except those that are offered by the parent Department (Please refer to the list of Open electives). Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the program.
- The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the program.
- Registration to electives shall be documented under the guidance of the Program Coordinator/Advisor/Mentor.

Courses from Law, Business (MBA), Medicine, Arts, Commerce, may be offered as Open Elective Courses (OEC). However, the college has to take approval from the University if such courses are not listed in the group at least one month before the commencement of the semester.

The minimum students' strength for offering professional electives is 05, if the strength is less than the 05 then colleges have to take the permission to offer the course from the University.

Professional Core Course (Integrated): Theory Syllabus of Professional Core Courses integrated with Practical Syllabus of the same course. Credit for integrated subject will be (L:T:P = 3:0:2)/(L:T:P = 2:2:2) = 04. In such a course there is no Semester End Examination (SEE) for the practical syllabus of the course, however Continuous Internal Evaluation (CIE) will be conducted for the practical topics.

Ability Enhancement Courses-V	
21MEA51	Introduction to AI and ML
21MEA52	CNC Programming and Simulation
21MEA53	Business Analytics with Python – I - Business Analytics

5 TH SEMESTER			
THEORY OF MACHINES			
Course Code	21ME501	CIE Marks	50
Teaching Hours/Week(L:T:P:S)	(2:2:0:0)	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3
Course Learning Objectives: <div>1. Improve the engineering knowledge by studying mechanism and their inversions that are required to construct a machine with the help of different linkages.</div> <div>2. Analyze the forces acting on various links of an engine mechanism and the torque on the crank, Calculate Torque and forces on various links subjected to external forces and to know the necessity of balancing in high speed engines.</div> <div>3. Design and analyze the cam system. Understand the effects of gyroscopic couple on an aero plane, know the stability of a four wheel and two-wheeler vehicles in a curved path.</div> <div>4. Develop student’s ability to understand the basic terminologies of gear and its characteristics. Understand engineering fundamentals of power transmission in gear trains.</div> <div>5. Calculate the natural frequency of a single degree freedom system and to model mechanical systems involving springs and masses.</div>			
UNIT - I			
Introduction: Definitions Link or element, Kinematic pairs, Degrees of freedom, Grubler’s criterion (without derivation), Kinematic chain, Mechanism, Structure, Mobility of Mechanisms (with problems), Inversion, Machine. Inversion of single slider and four bar mechanisms. Static force Analysis: Static equilibrium. Equilibrium of two and three force members. Members with two forces and torque, Static force analysis of four bar mechanism and Slider-crank mechanism without friction. Static and dynamic balancing: balancing of rotating mass by balancing masses in same plane. <div>15 Hours</div>			
Pedagogy	Chalk and talk, Power point presentation, Videos		
UNIT - II			
CAMS: Types of cams, Types of followers, Displacement, disc cam with reciprocating follower having knife edge, roller, Disc cam with oscillating roller follower, Follower motions including SHM, Uniform velocity, Uniform acceleration and retardation. Gyroscope: Vectorial representation of angular motion, Gyroscopic couple. Effect of gyroscopic couple on plane disc, aero plane, stability of two wheelers and four wheelers, numerical problems. <div>15 Hours</div>			
Pedagogy	Chalk and talk, Power point presentation, Videos		
UNIT - III			
Gears and Gear Trains: Gear terminology, law of gearing, Path of contact Arc of contact, Contact ratio of spur gears. Simple gear trains, Compound gear trains for large speed. Epicyclic gear trains. Tabular methods of finding velocity ratio of epicyclic gear trains. Mechanical Vibration: Introduction, classification, single degree undamped free vibration including simple problems. <div>10 Hours</div>			
Pedagogy	Chalk and talk, Power point presentation, Videos		

Course outcome (Course Skill Set)

At the end of the course student will be able to

- CO 1** List the terminology connected with kinematics and identifies the mechanisms. Describe the working principle of a given machines.
- CO 2** Apply equilibrium conditions on links subjected to external forces and determine the pin forces and torque on different links of a mechanism. Describe and determine the balancing of rotating masses in a system
- CO 3** Design the cam profile for knife edge, roller for the given type of follower motions. Perform analysis of gyroscopes.
- CO 4** List the terminologies connected with gears determines the contact ratio. Identify the gear trains and calculate power transmission in gear trains.
- CO 5** Calculate the natural frequency of a single degree of freedom system and apply mathematical techniques to model mechanical systems involving springs and masses .

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.

Continuous Internal Evaluation:

1. Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2. The class teacher must decide the topic for closed book test and Written Quiz. In the beginning only teacher must announce the methods of CIE for the subject.

Semester End Examination:

Theory SEE will be conducted by University as per scheduled time table, with common question papers for subject

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.

Suggested Learning Resources:**TEXTBOOKS:**

1. Theory of Machines, by Rattan S.S., Tata McGraw – Hill, 3rd edition 2009.
2. Theory of Machines by Thomas Bevan-CBS Publishers, 3rd edition-2005.
3. Mechanisms and Dynamics of machinery by Mabie and Ocvirk, 4th edition, 1987
4. Mechanics of Machines by Ham, Cranes and Rogers, McGraw– Hill, 4th edition, 1958.

REFERENCE BOOKS:

1. Theory of Machines by V.P.Singh, 4rd edition, 2014.
2. Theory of Machines & Mechanisms by Shigley J.V. & Uickers J.J.2nd Edition, 1995.
3. Theory of Machines by Ballaney, 25th Edition, 2011.

E-BOOKS

1. The Theory of machines by J.S.Rao, New Age International Publishers, 2006.
2. Theory of machines by Sadhu Singh, Pearson Education, 2nd Edition, 2009.
3. Theory of mechanisms and machines by C.S. Sharma and K.Purohit, Prentice Hall of India Pvt. Ltd., 2006.
4. Theory of machines-Kinematics and Dynamics by B.V.R. Gupta, I.K. International Publishing house, 2011.
5. Mechanics of Machines by V.Ramamurthy, CRC Press, Narosa Publishing House, 2002.

Web links and Video Lectures (e-Resources):

2. <https://www.mooc-list.com/course/mechanics-kinematics-and-dynamics-edx>
3. <http://nptel.ac.in/courses/112104121/6>

Course Articulation Matrix :

Course Code / Name : 21ME51 / THEORY OF MACHINES															
Course Outcomes (CO)	Program Outcomes (PO)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2					1		2	1		1	2		3
CO 2	2	3	1			1	1	1	0	0	0	1	1	2	0
CO 3	2	3	2						1	1		1	3		2
CO 4	2	3	2			1	1	1	1	1		1	2		1
CO 5	1	3	1	0	0	1	0	0	0	0	0	1	0	1	0
1: Low 2: Medium 3: High															

MECHATRONICS

Course Code	21ME502	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(3:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	4	Exam Hours	03

Course Learning Objectives:

1. Understand basic mechatronic systems, mechanical components, actuators, sensors and with controllers of mechatronic systems. Gaining knowledge of pneumatic elements like valves, FRL UNIT s and pneumatic actuators
2. To familiarize with the various types mechanical switches, Solid state switches, drives and controls, characteristics and models of various electromechanical actuators. Provide sound understanding of signal conversion i.e. ADC to DAC and vice versa, amplifiers, comparators and basic architecture of PLC systems.
3. Understand architecture of 8085 microprocessors, micro controller, logic gates, and flip-flops
4. Analyse, design and develop the hydraulics and pneumatics circuits for industrial applications.
5. Analyse, design and develop the Electro pneumatic, electrohydraulic and PLC based control systems for automation task

UNIT - I

Introduction: Introduction to Mechatronic systems, Measurement systems, control systems, microprocessor-based controllers, Mechatronics approach. Examples and discussions on typical mechatronic systems. **Review of Transducers and Sensors:** Introduction to Transducers and sensors, their classification, light sensors, proximity sensors and Hall-effect sensor, encoders, selection of sensors.

Pneumatic Systems: Introduction, Basic structure of pneumatic systems, filter, lubricator, regulator, Valves Classification, Pressure control valve, Flow control valve, Direction control valve. Types of cylinders, air motors, air compressors, Symbols of Pneumatic elements, and application circuits.

15 Hours

Pedagogy

Chalk and talk, Power point presentation, Videos

UNIT - II	
<p>Drives and controls: Mechanical system: Anti Friction guide ways, timer belt and pulley, high speed precession bearings</p> <p>Electrical Actuation Systems: Actuators and actuator system, classification, Mechanical switches, Solenoids, relays, solid-state switches, Motors- DC & AC motors, Stepper motors, servo motor.</p> <p>Signal conditioning: Introduction to signal conditioning, Operational amplifier, Inverting, Non- inverting, Summing, Integration, Differential amplifier, protection, filtering, wheat stone bridge, Analog +Digital Converter & Digital- Analog Converter, Multiplexers, Data acquisition system. 15 Hours</p>	
Pedagogy	Chalk and talk, Power point presentation, Videos
UNIT - III	
<p>Microprocessors: Introduction to microprocessor, microprocessor based digital control, Basic elements of control system, 8085 A microprocessor architecture and terminology, Microcontrollers. Differences b/w microprocessor & micro controllers. Classification of micro controllers.</p> <p>Programmable logic controller: Introduction to PLC"s, basic structure, Principle of operation, Programming and concept of ladder diagram, concept of latching &selection of a PLC. Logic gate using PLC. 9 Hours</p>	
Pedagogy	Chalk and talk, Power point presentation, Videos
UNIT - IV (Lab Component)	
<p>Application of Quick Exhaust Valve, Time delay valve in an measuring device. Experiment on Paint bucket Circuit, Query stone sorting circuit, Pneumatic Rubbish compactor circuit 6 Hours</p>	
Pedagogy	Chalk and talk, Power point presentation, Active learning
UNIT - V (Lab Component)	
<p>Experiment on electro pneumatic circuit of a stamping device and clamping device. Demonstration on PLC 5 Hours</p>	
Pedagogy	Chalk and talk, Power point presentation, Active learning
<p>Course outcome (Course Skill Set) At the end of the course student will be able to</p> <p>CO 1 Summarize significance of mechatronics, demonstrate different transducers, which are used in vital mechatronic applications. Describe different pneumatic components along with their functions</p> <p>CO 2 Illustrate the operational characteristics of mechanical and electrical actuator systems. Describe the concept of Amplifiers, Filters, Analogue and digital signal, Converters (ADC, DAC) and DAQ for its industrial applications.</p> <p>CO 3 Utilize the knowledge of logic gates, microprocessor, microcontroller, and PLC. Develop PLC ladder programming for industrial applications.</p> <p>CO 4 Design, simulate and develop pneumatic circuits for Industrial applications using these pneumatic components.</p> <p>CO 5 Analyse the design and developing the Electro pneumatic and PLC based control systems</p>	

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.

Continuous Internal Evaluation:

1. Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2. The class teacher must decide the topic for closed book test and Written Quiz. In the beginning only teacher must announce the methods of CIE for the subject.

Semester End Examination:

Theory SEE will be conducted by University as per scheduled time table, with common question papers for subject

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.

Suggested Learning Resources:**TEXTBOOKS:**

1. "Mechatronics ", W. Bolton, person education, third edition. 2013
2. "Microprocessor Architecture, programming and applications with 8085.8085 R.S. Ganokar, Wiley Eastern.1987
3. Introduction to Mechatronics", K. K. Appukuttan, Oxford University press, 2007 edition
4. Pneumatic systems S. R Majumdar, Tata Mc.Graw-Hill, Publishing company, Ltd. 1997

REFERENCE BOOKS:

1. Mechatronics, Nitaigour Premchand Mahilik, Tata Mc.Graw-Hill, Publishing company, Ltd. 2003
2. Pneumatics Basic level TP101, Peter Croser and Frank Ebel, Festo Didactic Publications. 2003
3. Fundamentals of pneumatic control engineering, J.P. Hasebrink and R.Kobbler, Festo Didactic Publications. 1978
4. A Textbook of Mechatronics, RK Raput, S.Chand Publishing

Web links and Video Lectures (e-Resources):**Course Articulation Matrix :**

Course Code / Name : 21ME52 / MECHATRONICS															
Course Outcomes (CO)	Program Outcomes (PO)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	1	1		1				3	1		2	3	1	2
CO 2	3	2	2	2	2				2	1	2	2	3	1	2
CO 3	3	2	3	2	3				3	2	2	3	3	1	2
CO 4	3	3	3	1	2				3	2	2	2	3	1	2
CO 5	3			2	3				3	2	2	3	3	1	2

1: Low 2: Medium 3: High

ENGINEERING ECONOMICS			
Course Code:	21ME503	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(3:0:0:0)	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3
Course Learning Objectives: <ol style="list-style-type: none">1. Analyse the time value of money.2. Evaluate the worth of creations, by comparing the alternatives visa, vis the cost (cost-benefit analysis)3. Take decisions with the limited resources, the relevant course of action, with the help of suitable tools.4. Determine the cost involved in each operations, a product should undergo with an aim to fix suitable selling price for the product5. Know the different terminology of Economics and to prepare ledgers, journals, balance sheets and profit and loss accounts.			
UNIT – I			
Fundamental economic concepts Consumer goods, Producer goods, Factors of production, Economy of organization, Demand theory, Law of demand, Exceptions to law of demand, Law of supply, Determinants of supply, Law of increasing returns and law of diminishing returns(No exercises) Interest Rate of interest, Determining rate of interest, Time value of money, Simple interest, Compound interest, Nominal and effective interest rate, Equivalence involving interest, Interest formulae [single payment, uniform series and arithmetic gradient only], problems using interest formulae [discrete compounding only]. <div>15 Hours</div>			
Pedagogy	Chalk and talk, Power point presentation, Videos		
UNIT – II			
Economic Analysis of Alternatives Analysis based on: Present Worth [equal life and unequal life situations], Future Worth, Payback Period, Capitalized Worth, Equivalent Annual Worth, Exercises. Rate of Returns Analysis based on Rate of Return, Exercises, cost of capital concepts Depreciation Causes of depreciation, Depletion, Methods of depreciation [Straight line, Declining balance, Double declining balance, SYD method, Sinking Fund method], Exercises <div>15 Hours</div>			
Pedagogy	Chalk and talk, Power point presentation, Videos		

UNIT – III	
Estimating and Costing Components of cost [Material cost, Labour cost, Overhead expenses, Prime cost, Factory cost, Total cost], Determination of selling price of a product, Exercises Mensuration , Machine shop calculations, Forging shop calculations, Exercises Financial management Terminologies used in accounting, Journal and ledger, Profit and loss statement, Balance sheet, Understanding basic financial ratios, Simple exercises.	
10 Hours	
Pedagogy	Chalk and talk, Power point presentation, Videos
<u>Course outcome (Course Skill Set)</u> At the end of the course student will be able to : CO 1 Explain the fundamental economic concepts. CO 2 Use simple interest and compound interest to determine compounded and discounted amount. CO 3 Compare the alternatives using Present Worth, Equivalent Annual Worth and Future Worth methods. CO 4 Compare the alternatives using Internal Rate of Return methods and calculate the depreciated amount of a given assets using Straight line, Declining balance, Double declining g balance, Sum of year digit method and Sinking fund method. CO 5 Estimate the selling price of given product and prepare balance sheet and profit- loss account for given data of a firm.	
Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.	
Continuous Internal Evaluation: 1. Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%). 2. The class teacher has to decide the topic for closed book test and Written Quiz. In the beginning only teacher has to announce the methods of CIE for the subject.	
Semester End Examination: Theory SEE will be conducted by University as per scheduled time table, with common question papers for subject	
<ul style="list-style-type: none"> ● The question paper will have ten full questions carrying equal marks. ● Each full question will be for 20 marks. ● There will be two full questions (with a maximum of four sub- questions) from each module. ● Each full question will have sub- question covering all the topics under a UNIT 	

Suggested Learning Resources:**Books****TEXTBOOKS:**

1. Engineering Economics, Riggs J.L., 4th edition, Tata McGraw-Hill, 2004
2. Mechanical Estimating and Costing, Banga and Sharma, 16th edition, Khanna Publishers, 2012

REFERENCE BOOKS:

1. Engineering Economy, E Paul Degarmo, Macmillan Publishing, 2001
2. Engineering Economy, Gerald J Thuesen & W J Fabrycky, Prentice Hall of India, 9th ed.
3. Engineering Economics, Tarachand, Nemchand & Bros, 1996
4. Financial Management, I M Pandey, Vikas Publishing House, 2002

MOOC/NPTEL Resources:

1. <http://nptel.ac.in/courses/112107209/>

Course Articulation Matrix :

Course Code / Name : 21ME53 / ENGINEERING ECONOMICS															
Course Outcomes (CO)	Program Outcomes (PO)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	1				1			1	1		1			2
CO 2	2	3				1			1	1		1			2
CO 3	2	3				1			1	1		1			2
CO 4	2	3				1			1	1		1			2
CO 5	2	3				1			1	1		1			2

1: Low 2: Medium 3: High

AUTOMOTIVE ENGINEERING			
Course Code	21ME504	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(3:0:0:0)	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3
<u>Course Learning Objectives:</u> <ol style="list-style-type: none">1. Get an idea on the different components of an engine and its types with lubrication system.2. Understand the fuel supply system and ignition systems used in automobiles.3. Demonstrate the working of the transmission system.4. Explain the importance of suspension system, steering geometry and drives in automobiles5. Know the concept of braking system, tyres and emission control.			
UNIT - I			
ENGINE COMPONENTS AND COOLING & LUBRICATION SYSTEMS: SI & CI engines, Cylinder-arrangements and their relative merits, Liners, Piston, connecting rod, crankshaft, valves, valve actuating mechanisms, Choice of materials for different engine components, cooling requirements, methods of cooling, different lubrication arrangements, crankshaft/flywheel position sensor, accelerator pedal sensors, engine coolant water temperature sensor			
FUEL SUPPLY SYSTEMS FOR SI AND CI ENGINES: Fuel mixture requirements for SI engines, types of carburettors, simple carburettor, multi point and single point fuel injection systems, CRDI, fuel transfer pumps: AC Mechanical Pump, SU Electrical Pumps, fuel injection pumps and injectors, Fuel gauge sensor, Throttle position sensor, Mass air flow sensors, Turbocharger construction and operation.			
IGNITION SYSTEMS: Battery Ignition systems, magneto Ignition system, Electronic Ignition, Automatic Ignition advance systems, Lighting systems, Rain/Light sensors, starting device (Bendix drive).			
15 Hours			
Pedagogy	Power point presentation, Videos		
UNIT - II			
POWER TRAINS: Clutches- Single plate, multiplate, Gear box: Necessity for gear ratios in transmission, Constant mesh gear box, Synchromesh gear box, over drive, fluid coupling and torque converter, principle of automatic transmission, Vehicle Speed Sensors, calculation of gear ratios.			
DRIVE TO WHEELS: Propeller shaft, universal joints, Hotchkiss. And torque tube drives, differential, rear axle, steering geometry, camber, king pin inclination, included angle, castor, toe-in & toe-out, condition for exact steering, steering gears, power steering, over steer, under steer & neutral steer, Steering angle sensors			
SUSPENSION AND SPRINGS: Requirements, leaf spring, coil spring, Torsion bar suspension systems, independent suspension for front Wheel, Air suspension system.			
15 Hours			
Pedagogy	Power point presentation, Videos		
UNIT - III			
BRAKES: Types of brakes, mechanical, compressed air and hydraulic braking systems, construction and working of master and wheel cylinder, brake shoe arrangements, Disk brakes, Drum brakes			
TYRES: Desirable tyre properties, Types of tyres.			
AUTOMOTIVE EMISSION: Automotive exhaust emissions, sources and emission control method: EGR, SCR, Emission Standards, Exhaust sensors.			
Electric Vehicles- Introduction.			
10 Hours			

Pedagogy	Power point presentation, Videos
<p><u>Course outcome (Course Skill Set)</u></p> <p>At the end of the course student will be able to :</p> <p>CO 1 Describe and demonstrate the layout of an automobile and components of an automobile engine. Explain cooling and lubrication systems.</p> <p>CO 2 Explain and demonstrate the fuel supply and Ignition systems for SI and CI engines.</p> <p>CO 3 Describe and demonstrate the transmission system</p> <p>CO 4 Explain and demonstrate the components of drive to wheel and suspension system, calculate the parameters of steering geometry.</p> <p>CO 5 Describe and demonstrate automotive braking system. Explain types and construction of tyres and wheels. Explain the significance of automotive emissions and its controlling methods.</p>	
<p>Assessment Details (both CIE and SEE)</p> <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.</p> <p>Continuous Internal Evaluation:</p> <ol style="list-style-type: none"> 1. Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%). 2. The class teacher has to decide the topic for closed book test and Written Quiz. In the beginning only teacher has to announce the methods of CIE for the subject. <p>Semester End Examination:</p> <p>Theory SEE will be conducted by University as per scheduled time table, with common question papers for subject</p> <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub- questions) from each module. • Each full question will have sub- question covering all the topics under a module. 	
<p>Suggested Learning Resources:</p> <p>Books</p> <p>TEXTBOOKS:</p> <ol style="list-style-type: none"> 1. Automotive Mechanics by S. Srinivasan, Tata McGraw Hill, 2003 2. Automobile Engineering, Kirpal Singh, Vol I and II, 2013. 3. Automotive Electrical and Electronics, A. K. Babu, Khanna Publishers, 2nd edition, 2016 <p>REFERENCE BOOKS :</p> <ol style="list-style-type: none"> 1. Automobile Engineering, R. B. Gupta, Satya Prakashan, 4th Edn., 1984 . 2. Automobile Engineering, Narang, Khanna Publishers 2002 3. Automotive Mechanics, Crouse, McGraw Hill 2002 4. Automotive Mechanics, Joseph Heithner 2000 5. Automobile Mechanics by N. K. Giri, Khanna publishers 2002 6. Newton and Steeds Motor Vehicle, Butterworth, 2nd Edn. 1989. 7. Automobile Engineering by K. K. Jain and R. B_ Arshana, Tata McGraw Hill, 2002 8. Automobile Mechanics, A.K. Babu & S.C. Sharma, T.R. Banga, Khanna Book Publishing 9. A Textbook of Automobile Engineering, R.K. Rajput, Laxmi Publications 	
<p>Web links and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> 1. Fundamentals of Automotive Systems 	

Course Articulation Matrix :

Course Code / Name : 21ME54 / AUTOMOTIVE ENGINEERING

Course Outcomes (CO)	Program Outcomes (PO)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	1				1			3	1		1			3
CO 2	3	1				1			3	1		1			3
CO 3	3	1	1			1			3	1		1	1		2
CO 4	2	3	1			1			3	1		1	1		2
CO 5	3	1	1			1	1	1	3	1		1	1		2

1: Low 2: Medium 3: High

ENERGY CONVERSION ENGINEERING LAB

Course Code	21ME505	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(0:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	30	Total Marks	100
Credits	1	Exam Hours	3

Course Learning Objectives:

1. Find flash and fire point of lubricating oil using Abel Pensky and Pensky Martins apparatus.
2. Find caloric value of solid, liquid and gaseous fuels and select the fuel for combustion.
3. Find viscosity of lubricating oils using Redwood, Saybolt viscometers
4. Find variation of viscosity with temperature, select proper lubricating oil for various applications.
5. Draw valve timing/port opening diagram of four stroke and two stroke I.C engines and also find area of an regular/irregular surfaces using Planimeter.

Part-A

1. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Pensky Martins Apparatus.
2. Determination of Caloric value of solid, liquid and gaseous fuels.
3. Determination of Viscosity of lubricating oil using Redwoods, Saybolts
4. Valve Timing/port opening diagram of an I. C. engine (4 stroke/2 stroke).
5. Use of planimeter.

Part-B

Performance Tests on I. C. Engines, Calculations of IP, BP, Thermal efficiencies, SFC, FP, heat balance sheet for:

- (a) Four stroke Diesel Engine.
- (b) Four stroke petrol Engine.
- (c) Multi cylinder Diesel/Petrol Engine (Morse test)
- (d) Two stroke Petrol Engine.

Course outcome (Course Skill Set)

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

CO 1 Conduct performance tests on SI and CI engines and calculate IP, BP, Thermal efficiencies, SFC, FP and prepare heat balance sheets.

CO 2 Find flash and fire points, viscosity of lubricating oils. Draw valve timing/port opening diagrams for four stroke and two stroke I.C engines. Determine calorific value of fuels. Calibrate the plannimeter.

Suggested Learning Resources:

Books

TEXTBOOK:

1. Engineering Thermodynamics, P.K.Nag , McGraw Hi11, III Edition, 2005

Web links and Video Lectures (e-Resources):**Course Articulation Matrix :**

Course Code / Name : 21ME55 / ENERGY CONVERSION ENGINEERING LAB															
Course Outcome s (CO)	Program Outcomes (PO)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	3				1	1		3	2				2	
CO 2	3	2				1	1		3	2				2	

1: Low 2: Medium 3: High

RESEARCH METHODOLOGY AND IPR			
Course Code	21HU511	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(2:0:0:0)	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	2	Exam Hours	3
Course Learning Objectives: 1. To explain the significance of carrying out research work, 2. To explain the Research Problem, Review the literature. 3. To understand Research Design, methodological way of execution. 4. To understand Data Collection, and Interpretation and Report Writing. 5. To appreciate the importance of Intellectual property rights protection.			
UNIT - I			
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method. Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration. Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed. <div>9 Hours</div>			
UNIT - II			
Research Design: Need for Research Design, Features of a Good Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. Design of Sample Surveys: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method. Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout. Interpretation and Report Writing (continued): Types of Reports, Mechanics of Writing a Research Report, Precautions for Writing Research Reports. <div>9 Hours</div>			
Pedagogy	Chalk and talk, Power point presentation, Videos		

UNIT - III**Introduction to Intellectual Property**

Intellectual Property (IP) – Importance, Jurisprudential definition and concept of property, rights, duties and their correlation; evolution of IPR – Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications.

Agreements and Treaties

TRIPS Agreement; Madrid Agreement; Hague Agreement; WIPO Treaties; Budapest Treaty; Indian Patent Act 1970 & recent amendments – Patent (Amendment) Rules, 2017.

Basics of Patents and Concept of Prior Art

Introduction to Patents; Types of patent applications, Specifications: Provisional and complete; Forms and fees Invention in the context of “prior art”. Patent databases

Patent filing procedures

National & PCT filing procedure; Status of the patent applications filed; Structure of Patent document, Precautions while patenting – disclosure/non-disclosure; Patent licensing and agreement; Patent infringement- meaning, scope, litigation.

7 Hours

Pedagogy	Chalk and talk, Power point presentation, Videos
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Course outcome (Course Skill Set)

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

CO1: Explain the significance of carrying out research work and identifying a research problem and perform e literature review.

CO2: Explain the Research Design, methodological way of execution, Data Collection, and Interpretation and Report Writing.

CO3: Explain the importance of Intellectual property rights and patents.

PO-CO mapping															
Course Outcomes (CO)	Program Outcomes (PO)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	1	1							3					1
CO 2	3	3	2			1	1								1
CO 3	1	1				3	2	2		3					1

1: Low 2: Medium 3: High

CIE Scheme

Assessment	Weightage in marks
MSE -I	20 marks
MSE -II	20 marks
Task –I	5 marks*
Task –II	5 marks
TOTAL	50marks

* Students shall be made to review literature and prepare aa report.

Scheme for Semester End Examination

UNIT	8 questions to be set of 20 marks each	Instructions
I	Q.NO.1, Q.NO. 2, Q.NO.3	Solve any two out of 3
II	Q.NO.4, Q.NO. 5, Q.NO. 6	Solve any two out of 3
III	Q.NO.7, Q.NO. 8	Solve any one out of 2

Books**TEXTBOOKS:**

- 1 Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International 4th Edition, 2018
- 2 Research Methodology a step-by step guide for beginners. (For the topic Reviewing the literature under module 2), Ranjit Kumar, SAGE Publications Ltd . 3rd Edition, 2011
- 3 Study Material (For the topic Intellectual Property under module 5) Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013

REFERENCE BOOKS:

- 1 Research Methods: the concise knowledge base Trochim Atomic Dog Publishing 2005.
- 2 Conducting Research Literature Reviews: From the Internet to Paper Fink A Sage Publications, 2009.

Web links and Video Lectures (e-Resources):

NPTEL course material related to operations management, operations research and entrepreneurship.

ENVIRONMENTAL STUDIES

Course Code	21CV512	CIE Marks	50
Teaching Hours/Week(L:T:P:S)	(1:0:0:0)	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	1

Course Learning Objectives:

1. To raise consciousness about environmental conditions and to imbibe environmentally appropriate behaviour.
2. To equip the engineering undergraduates to identify the significance of environmental practice in their daily life and in the engineering practices.
3. To make them conscious of understanding the environment where we live and act up on.

UNIT – I

Environment- Definition, significance of environmental studies current scenario, local, regional, national and global problems, Components of environment: atmosphere, hydrosphere, lithosphere and biosphere. Layers of atmosphere and its role. Parts of Earth lithosphere and its role; hydrological cycle

Eco system-Definition, ecology and environment, ecosystem components: biotic and abiotic components; ecological balance; elements of ecosystem: biotic, abiotic; producers, consumers and decomposers. Habitat, range of life, Biome,

<p>balanced eco system, food chain, food web and ecological pyramids.</p> <p>Human activities- The Anthropogenic System human activities like growing food, building shelter and other activities for economy and social security. Soil erosion, water logging definition. Organic farming definition</p> <p>Natural resources- Resources, Natural resources, water, minerals, Fossil fuels and energy</p> <p>Water resources - Global water resources: distribution, uses of water for irrigation, domestic and industrial purposes in India.</p> <p>Quality aspects - Water quality parameters, drinking water standards for turbidity, pH value, total hardness, iron, fluoride, lead, arsenic, nitrate</p> <p>Mineral resources - Metallic minerals, non metallic minerals</p> <p>Fossil fuels - Coal and petroleum</p> <p>Forest Wealth - Components of the forest, key benefits of forests. Deforestation environmental effects of deforestation and remedies Sustainable development definition, objectives</p> <p>Material cycles - Carbon, nitrogen and sulphur cycles.</p>	
6 Hours	
Pedagogy	Chalk and talk, Power point presentation, Videos
UNIT – II	
<p>Environmental pollution: Definition, harmful effects related to public health</p> <p>Water pollution: Definition, types and sources agriculture (pesticides and fertilizers), industry, domestic and mining, harmful effects, water borne and water induced diseases definition, common diseases and their causatives, Fluoride problem in drinking water</p> <p>Land pollution: Definition, sources_ agriculture, housing, industry, mining, transportation. Types of municipal Solid waste Disposal (Sanitary landfills, composting, incineration (in brief) and effects</p> <p>Air Pollution - Air Pollution Definition, types and sources: industry, mining, agriculture, transportation and effects</p> <p>Noise pollution: Noise pollution: Definition, sources, mining, industries, railroads, aviation, effects and control measures</p> <p>Energy - Different types of energy, Nonrenewable energy; fossil fuels, coal, oil and natural gas brief description only. Nuclear energy nuclear power plants, Renewable energy: solar energy, Photovoltaic systems for street and domestic lighting, solar water heating brief description only, Wind energy-definition, merits and demerits, Hydro power definition, merits and demerits. Biomass energy- definition, sources of bioenergy, biogas, biofuels, India's position in renewable energy, Hydrogen as an alternative future source of energy brief scope, fuel cells.</p>	
6 Hours	
Pedagogy	Chalk and talk, Power point presentation, Videos
UNIT - III	
<p>Current environmental issues of importance - Population growth, Definition, growth rate, effects, remedies</p> <p>Urbanization - Definition, environmental impacts and remedies</p> <p>Global warming and climate change - Concept of greenhouse effect, sources of greenhouse gases, effects and remedial measures of greenhouse gases</p> <p>Acid rain: Definition, causes and effects, control measures.</p> <p>Ozone Depletion: Definition, causes, effects and control measures.</p> <p>Environmental Impact Assessment- EIA definition, objectives and benefits of EIA</p>	
3 Hours	
Pedagogy	Chalk and talk, Power point presentation, Videos
<p>Course outcome (Course Skill Set)</p> <p>At the end of the course student will be able to</p> <p>CO 1 To create and raise an awareness about environmental issues and to inculcate environmentally appropriate behaviour.</p> <p>CO 2 To make the engineering undergraduates identify the importance of environmental practice in their daily life and in the engineering practices.</p> <p>CO 3 To inculcate an understanding of the environment where we live and act up on.</p>	

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.

Continuous Internal Evaluation:

3. Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
4. The class teacher must decide the topic for closed book test and Written Quiz. In the beginning only teacher must announce the methods of CIE for the subject.

Semester End Examination:

- Multiple choice questions: 100 questions, conducted online via Moodle LMS.

Suggested Learning Resources:**TEXTBOOKS:**

1. Benny Joseph (2005), "Environmental Studies", Tata McGraw Hill Publ. Co., New Delhi.
2. Rajagopalan, R. (2005), "Environmental Studies: From Crisis to Cure", Oxford University Press, London

REFERENCE BOOKS

1. Balasubramanya, N and Chatwal, Gurdeep R. (2007), "Environmental Studies", Himalaya Publishing House, Mumbai
2. Barucha, E. (2004), "Environmental Studies", University Grants Commission, New Delhi
3. Bhatia, S. C. (2005), "Environmental Chemistry", CBS Publishers, New Delhi
4. De, A.K. and De, A. K. (2006), "Environmental Studies"
5. Keller, Edward A., (1985), "Environmental Geology", CBS Publishers and Distributors, Delhi.

Web links and Video Lectures (e-Resources):**Course Articulation Matrix :**

Course Code / Name : 21CIV58 / ENVIRONMENTAL STUDIES															
Course Outcomes (CO)	Program Outcomes (PO)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3								1			1			
CO 2	3						2		1			1			
CO 3	3		1				2		1			1			
1: Low 2: Medium 3: High															

INTRODUCTION TO AI AND ML			
Course Code	21MEA51	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(1:0:0:0)	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	3
Course Learning Objectives: To understand the fundamentals of AI and ML and its applications			
UNIT - I			
Introduction to AI, Applications, basics of AI, ANN basics – perceptron, MLP, FFNN, Backpropagation, - 5 Hours			
Pedagogy	Chalk and talk method, Power Point Presentation		
UNIT - II			
Introduction to ML, ML techniques overview, significance of feature extraction and dimensionality reduction, clustering, Artificial neural networks, Support vector machines - 5 Hours			
Pedagogy	Chalk and talk method, Power Point Presentation		
UNIT - III			
Introduction to Deep learning, difference between ML and DL, Convolutional neural networks, Recurrent neural networks, applications - 5 Hours			
Pedagogy	Chalk and talk method, Power Point Presentation		
Course outcome			
At the end of the course student will be able to			
1. Explain about AI, its basics, significance and its applications			
2. Describe about ML, different techniques, about the significance of feature extraction and dimensionality reduction and about artificial neural networks and support vector machines.			
3. Differentiate between ML and DL, explain convolutional and recurrent neural networks and its applications.			
Assessment Details (both CIE and SEE)			
(methods of CIE need to be define topic wise i.e.- MCQ, Quizzes, Open book test, Seminar or micro project)			
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.			
Continuous Internal Evaluation:			
• Methods suggested: Test, Open Book test, Written Quiz, Seminar, report writing etc.			
• The class teacher has to decide the topic for closed book test, open book test, Written Quiz and Seminar. In the beginning only teacher has to announce the methods of CIE for the subject.			
Semester End Examination:			
Theory SEE will be conducted by University as per scheduled time table, with common question papers for subject			
• The question paper will have ten questions. Each question is set for 20 marks.			
• There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub questions), should have a mix of topics under that module.			
• The students have to answer 5 full questions, selecting one full question from each module			

Suggested Learning Resources:**BOOKS:**

1. Stuart J. Russel & Peter Norvig, Artificial Intelligence – A Modern Approach, Third Edition, Pearson Education India, ISBN-13 : 978-9332543515.
2. Ethem Alpaydin, Introduction to Machine learning, The MIT Press Reader, 2014, ISBN: 9780262028189

Web links and Video Lectures (e-Resources):

COURSERA

NPTEL

PO-CO mapping:

Course Code / Name : 21MEA42/Introduction to AI and ML																
Course Outcomes (CO)	Program Outcomes (PO)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO 1	2					1				1		2	1	1	1	
CO 2	2					1				1		2	1	1	1	
CO3	2					1				1		2	1	1	1	

1: Low 2: Medium 3: High

CNC PROGRAMMING AND SIMULATION			
Course Code	21MEA52	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(0:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	3
Course Learning Objectives:			
This Course will enable students to,			
<ol style="list-style-type: none"> 1. Explain the construction, features, applications and advantages of Computer numerical controlled (CNC) machines and technology. 2. Understand the CNC programming part using ISO codes. 3. Write, analyze the manual part programming for simple parts produced in CNC turning centre and simulate. 4. Write, analyze the manual part programming for simple parts produced in CNC milling machine and simulate. 			
UNIT - I			
Basic constructional features, operations and applications of a CNC Turning center. Writing manual part programming using ISO codes for machining of simple machine parts in CNC turning machine and machining the model. (4 Exercises on external and internal turning cycles)			
Pedagogy	Chalk and talk, Power point presentation, Videos		

UNIT - II	
Basic constructional features, operations and applications of a CNC vertical machining center. Writing manual part programming using ISO codes for machining of simple machine parts in CNC milling machine. (4 exercises on grooving, slab, pocket and drilling cycles).	
Pedagogy	Chalk and talk, Power point presentation, Videos
Course outcome (Course Skill Set) <ol style="list-style-type: none"> 1. Demonstrate the simulation of the tool path for the given part by using Numerical Control (NC) codes for CNC turning. Demonstrate the use of machining cycles and subprograms for repetitive tool path applications in turning. 2. Demonstrate the simulation of the tool path for the given part by using Numerical Control (NC) codes for CNC milling. Demonstrate the use of machining cycles and subprograms for repetitive tool path applications in milling. 	
Assessment Details (both CIE and SEE) (methods of CIE need to be define topic wise i.e.- MCQ, Quizzes, Open book test, Seminar or micro project) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain minimum of 40% marks individually both in CIE and SEE to pass. Practical Semester End Exam (SEE) is conducted for 50 marks (3 Hours duration). Based on this grading will be awarded. Continuous Internal Evaluation: <ul style="list-style-type: none"> • Methods suggested: Test, Open Book test, Written Quiz, Seminar, report writing etc. • The class teacher has to decide the topic for closed book test, open book test, Written Quiz and Seminar. In the beginning only teacher has to announce the methods of CIE for the subject. Semester End Examination: A practical SEE will be conducted by University as per scheduled time table, with common question papers for subject <ul style="list-style-type: none"> • One Question from UNIT I - 20 marks • One Question from UNIT II - 20 marks • Programming modifications/ Viva- Voce - 10 marks 	
Suggested Learning Resources: BOOKS: <ol style="list-style-type: none"> 1. CAD/CAM: computer aided design and manufacturing, Groover Mikell P, Zimmered W Emory, Prentice Hall 2014 2. Computer Numerical Control- Turning and Machining centers. Quesada Robert, Prentice Hall 2014 	
Web links and Video Lectures (e-Resources): <ol style="list-style-type: none"> 1. https://www.classcentral.com/course/youtube-computer-numerical-control-cnc-of-machine-tool-and-process-47871 2. https://www.udemy.com/course/mastering-artcam-2017/ 	
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning <ul style="list-style-type: none"> • https://fab-coep.vlabs.ac.in/exp1/Video.html?domain=Mechanical%20Engineering&lab=FAB%20laboratory • http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAM/exp2/index.html# 	

CO-PO Mapping:

Course Code / Name: 21MEA44 / CNC Programming and Machining															
Course Outcomes (CO)	Program Outcomes (PO)												PSO		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1	1	2	1		3			1	3	2			1	-	3
CO 2	2	2	1		3			1	3	2			1	-	3

1: Low 2: Medium 3: High

BUSINESS ANALYTICS WITH PYTHON I – PREDICTIVE ANALYTICS			
Course Code	21MEA53	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(1:0:0:0)	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	1
Course Learning Objectives: 1. Apply the concepts of predictive analytics and solve problems related to hypothesis testing, control charts, regression and correlation and time series analysis. 2. Apply relevant python toolboxes/ modules to programs for problems related to predictive analytics.			
UNIT - I			
Introduction to Business Analytics Types of data, representation of data using Measures of central tendency and dispersion, Central Limit theorem. Predictive Analytics Hypothesis Testing & Business Analytics Hypothesis Testing: Null and Alternative Hypotheses; Z Test, t test and F test. Control charts for variables: Control Charts for X-Bar and R- Charts, Type I and Type II errors, Simple Numerical Problems, Process capability: The foundation of process capability, Natural Tolerance limits, c_p – process capability index, c_{pk} . – Process capability ratio, Concept of Six sigma Correlation: Linear (Simple and Multiple) correlation and linear regression. Time Series Analysis: Components of time series, Trend analysis: Least Square method of Forecasting, Numerical Problems.			
			8 Hours
Pedagogy	Power point presentation, Videos		
UNIT - II			
Python Modules & Packages for Data Science/ Analytics: Pandas, Matplotlib, NumPy, Dataframe, and other toolboxes of Python to help solve Predictive analytics problems. Python application in prescriptive Analytics: Application of Python modules to solve at least one problem of Data retrieval from spreadsheets, Z test, t test and F tests, Time Series analysis, Correlation, and regression, plotting control charts and finding process capability.			
			7 Hours

Pedagogy	Power point presentation, Videos
<u>Course outcome (Course Skill Set)</u> At the end of the course student will be able to : CO 1 Apply concepts of predictive analytics and solve problems related to hypothesis testing, control charts, regression and correlation and time series analysis. CO 2. Apply relevant python modules/ toolboxes to write programs to solve predictive analytics problems	
Assessment Details (both CIE and SEE) <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.</p> Continuous Internal Evaluation: <ol style="list-style-type: none"> 1. Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%). 2. The class teacher has to decide the topic for closed book test and Written Quiz. In the beginning only teacher has to announce the methods of CIE for the subject. Semester End Examination: <p>Theory SEE will be conducted by University as per scheduled time table, with common question papers for subject</p> <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub- questions) from each module. • Each full question will have sub- question covering all the topics under a module. 	
Suggested Learning Resources: Books TEXTBOOKS: <ol style="list-style-type: none"> 1. Production and Operations Management, William J Stevenson, Tata McGraw Hill, 8thEdition. 2011 2. Total Quality Management, Dale H. Besterfield et al., Pearson Education, 3rd edition, 2011 3. Introduction to Data Science, - A Python Approach to Concepts, Techniques and Applications, Laura Igual, Santi Segu, Springer, 2017 4. Think Python, How to Think Like a Computer Scientist, Allen Downey, Green Tea Press, 2012 (ebook) REFERENCE BOOKS : <ol style="list-style-type: none"> 1. Statistical Quality Control, E.L. Grant and R.S. Leavenworth, 7th edition, McGraw- Hill publisher, 2004. 2. Production / Operations Management, Joseph G Monks, McGraw Hill Books, 2001 3. Production / Operations Management, R. Pannerselvam, PHI India, 2011 	
Web links and Video Lectures (e-Resources): <ol style="list-style-type: none"> 1. NPTEL course material related to business analytics. 2. python.org 3. stackoverflow.com 4. openbookproject.net/thinkcs/python/english2e 5. automatetheboringstuff.com 	

Course Articulation Matrix :

Course Code / Name : 21MEA55 / BUSINESS ANALYTICS WITH PYTHON I

Course Outcomes (CO)	Program Outcomes (PO)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2									3	1			3
CO 2	3	2			3				3			1			3

1: Low 2: Medium 3: High

6 TH SEMESTER			
OPERATIONS MANAGEMENT AND ENTREPRENEURSHIP			
Course Code	21ME601	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(3:0:0:0)	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3
Course Learning Objectives:			
<div>1. Define production/operations management. Differentiate between Production and service system and types of production systems, Solve decision-making problems using break even analysis and decision tree methods.</div> <div>2. Apply the concepts of Design and System capacity. Solve problems on facility location using break even analysis and transportation method. Solve problems related to product and process layouts</div> <div>3. Describe the different forms of organization. Discuss the issues related to entrepreneurship, characteristics of entrepreneurs and intrapreneurs.</div> <div>4. Solve problems related to project networks, by identifying critical path, maximum duration and different floats. Predict the probable time of project completion with variance using program evaluation and review technique.</div> <div>5. Discuss the different studies carried out during project appraisal. Discuss the characteristics and necessity of small scale industries. Identify and differentiate the different national and state level funding agencies.</div>			
UNIT - I			
<div>Introduction to meaning and fundamental functions of management.</div> <div>Production and Operations Management: Introduction, Functions within business organizations, the operation management function, Classification of production systems, Productivity, factors affecting productivity,</div> <div>Decision Making: The decision process, characteristics of operations decisions, use of models - decision making environments. Break even Analysis, Decision trees.</div> <div>Capacity, Location and Layout Planning: Importance of capacity decisions, defining and measuring capacity, determinants of effective capacity.</div> <div>Design, System an actual capacity. System efficiency and utilization. Determination of Equipment requirement for a single stage production processes. Numerical problems on the above.</div> <div>Facilities location: Need for location decisions, nature of locations decisions, general procedure for making locations decisions, Use of Breakeven analysis and Transportation algorithms for making location decisions.</div> <div>16 Hours</div>			
Pedagogy		Chalk and talk method, Power Point Presentation	
UNIT - II			
<div>Forms of Business Organization: Types of ownership Characteristics, merits and demerits of Proprietorship, Partnership, Private limited Company, Public limited Company, Public sector organizations and Co-Operative enterprises, Incorporation of joint stock company, Methods of raising capital</div> <div>Facilities layout: Need for layout decisions. Minimizing material handling cost in process layout using Load distance analysis, Simple line balancing problems in product layouts.</div> <div>PERT-CPM TECHNIQUES: Network construction, common errors, dummy activities, Determining Earliest times, Latest times and floats, Scheduling by network, Determining critical path, Numerical problems on Earliest times, Latest times and floats and critical path, Determination of shortest route. Numerical problems, Resource Allocation- crashing of networks, Variance under probabilistic models, Difference between PERT & CPM, prediction of date of completion, Numerical problems</div> <div>16 Hours</div>			
UNIT - III			
<div>ENTREPRENEURSHIP: Concept of Entrepreneurship, Stages in entrepreneurial process, Role of entrepreneurs in Economic Development, Barriers to Entrepreneurship, Meaning of Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneurs, Intrapreneur - an emerging Class.</div>			

Small Scale Industries: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI, Steps to start and SSI, Government policy towards SSI; Different Policies of SSI.	
8 Hours	
Pedagogy	Chalk and talk method, Power Point
<u>Course outcome (Course Skill Set)</u> At the end of this course the student will be able to	
<p>CO1 Describe management and production/operations management. Differentiate between Production and service system and types of production systems, Solve decision-making problems using break even analysis and decision tree methods.</p> <p>CO 2 Apply the concepts of Design and System capacity. Solve problems on faculty location using break even analysis and transportation method.</p> <p>CO 3 Describe the different forms of organization. Solve problems related to product and process layouts</p> <p>CO 4 Solve problems related to project networks, by identifying critical path, maximum duration and different floats and crashing. Predict the probable time of project completion with variance using program evaluation and review technique.</p> <p>CO 5 Discuss the issues related to entrepreneurship, characteristics of entrepreneurs and intrapreneurs. Discuss the characteristics and necessity of small-scale industries. Identify and differentiate the different national and state level funding agencies.</p>	
Assessment Details (both CIE and SEE) <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.</p>	
Continuous Internal Evaluation: <ol style="list-style-type: none"> 1. Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%). 2. The class teacher has to decide the topic for closed book test and Written Quiz. In the beginning only teacher has to announce the methods of CIE for the subject. 	
Semester End Examination: <p>Theory SEE will be conducted by University as per scheduled time table, with common question papers for subject</p> <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub- questions) from each module. Each full question will have sub- question covering all the topics under a module. 	
Suggested Learning Resources: Books TEXTBOOKS: <ol style="list-style-type: none"> 1. Production / Operations Management, Joseph G Monks, McGraw Hill Books 2. Production and Operations Management, William J Stevenson, Tata McGraw Hill, 8th Edition. 3. Dynamics of Entrepreneurial Development & Management – Vasant Desai – Himalaya Publishing House 4. Entrepreneurship Development – Poornima. M. Charantimath – Small Business Enterprises – Pearson Education – 2006 (2 & 4). 5. Quantitative Techniques in Management, N.D. Vohra, Tata McGraw Hill, 2015 	

REFERENCE BOOKS:

1. Statistical Quality Control: E.L. Grant and R.S. Leavenworth, 7th edition, McGraw- Hill publisher, 2004.
2. Operations Research, Prem Kumar Gupta, D S. Hira, S Chand Publications, New Delhi, 2nd edition 2008
3. Entrepreneurship Development – S.S.Khanka – S.Chand & Co.

Web links and Video Lectures (e-Resources):

NPTEL course material related to operations management, operations research and entrepreneurship

Course Articulation Matrix :

Course Code / Name : 21ME61 / OPERATIONS MANAGEMENT AND ENTREPRENEURSHIP

Course Outcomes (CO)	Program Outcomes (PO)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	1									2				3
CO 2	2	2									2				3
CO 3	1														1
CO 4	3	2									3				3
CO 5	1	1									1				2

1: Low 2: Medium 3: High

HEAT TRANSFER			
Course Code	21ME602	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(2:2:2:0)	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	04	Exam Hours	3
Course Learning Objectives: <div><div>1. Get the idea of modes of heat transfer and their governing laws and steady state heat conduction equations.</div><div>2. Know the importance of application of fins in heat transfer equipment's and understand unsteady conduction.</div><div>3. Understand radiation and laws governing them and to know the application of boundary layer concept to heat transfer.</div><div>4. Conduct experiments related to steady state conduction and heat exchangers.</div><div>5. Conduct experiments related to free and forced convection , radiation and concepts of boiling and condensation.</div></div>			
UNIT - I			
Introductory Concepts and Definitions: Modes of heat transfer; Basic laws governing conduction, convection, and radiation heat transfer; Thermal conductivity; convective heat transfer coefficient; Radiation heat transfer coefficient.			
Conduction-Basic Equations: General form of three-dimensional heat conduction equation in rectangular, coordinate. Discussion (no derivation) on three-dimensional conduction in cylindrical and spherical coordinate systems.			
One-Dimensional Steady State Conduction: Steady state conduction in a slab, in a cylinder and in a sphere without heat generation. Overall heat transfer coefficient for a composite medium; thermal contact resistance; critical thickness of insulation.			
Heat Conduction Through Finned Surfaces Steady state conduction in fins of uniform cross section long fin, fin with insulated tip and fin with convection at the tip; fin effectiveness and efficiency.			
One-Dimensional Transient Conduction: Conduction in solids with negligible internal temperature gradients (Lumped system analysis); Use of transient Temperature charts (Heisler's Charts) for transient conduction in slab, long cylinder, and sphere.			
14 Hours			
Pedagogy		Chalk and talk method, Power Point Presentation	
UNIT - II			
Radiation Heat Transfer: Thermal radiation: Definitions of various terms used in radiation heat transfer; Stefan-Boltzman law, Kirchoff's law, Planck's Law and Wein's displacement law' Radiation heat exchange between two parallel infinite black surfaces (no derivation, equation only) between two parallel infinite nonblack surfaces (derivation) Effect of radiation shield; Intensity of radiation and solid angle; Lambert's Law.			
Concepts and Basic Relations in Boundary Layers: Flow over a body-Velocity boundary layer; Critical Reynolds number; General expressions for drag coefficient and drag force; Thermal boundary layer; general expression for local and average heat transfer coefficient; Nusselt number. Expressions for friction factor for hydro dynamically developed laminar flow through tubes.			
Forced Convection: Application of dimensional analysis for forced convection problems. Physical significance of Reynolds, Prandtl and Nusselt numbers. Use of various correlations for hydro -dynamically and thermally developed external and internal flows.			
Free or Natural Convection: Application of dimensional analysis for free convection- physical significance of Grashoff number; Use of correlations for free convection from or to vertical, horizontal flat plates, vertical and horizontal cylinders and spheres.			
14 Hours			

Pedagogy	Chalk and talk method, Power Point Presentation
UNIT - III	
Condensation and Boiling: Types of condensation; Nusselt's theory for laminar condensation on a vertical flat surface-expressions for film thickness and heat transfer coefficient; use of correlations for condensation on inclined flat surfaces, horizontal tube, and horizontal tube banks; Reynolds number for condensate flow; Regimes of pool boiling-Pool boiling correlations.	
Heat Exchangers: Classification of heat exchangers; overall heat transfer coefficient, fouling and fouling factor; LMTD and NTU methods of analysis of heat exchangers.	
11 Hours	
Pedagogy	Chalk and talk method, Power Point Presentation
UNIT - IV (Lab Component)	
11 Hours	
1. Thermal Conductivity of Metal Rod 2. Thermal Conductivity of Insulating Powder 3. Thermal Conductivity of Liquid 4. Heat Transfer Through Composite Walls 5. Heat Exchangers	
UNIT - V (Lab Component)	
6. Natural Convection 7. Pin-Fin Natural Convection 8. Pin-Fin Forced Convection 9. Stefan Boltzman Constant Apparatus 10. Emissivity Measurement of Radiating Surface 11. Vapour Compression Refrigeration 12. Condensation in Dropwise and Film wise Forms	
<u>Course outcome (Course Skill Set)</u> At the end of the course the student will be able to CO 1 Apply the basic knowledge of mathematics, science, and engineering to understand and analyze the basic laws, principles, and modes of steady state conduction. Understand and analyze complex engineering problems related to finned surfaces and unsteady conduction. CO 2 Apply engineering knowledge to solve complex problems of radiation heat transfer and radiation shielding to create sustainable environment. Understand the principles of boundary layer theory in free and forced convection heat transfer to design suitable solution to complex problems. CO 3 Analyze and interpret complex problems related to boiling and condensation, and design of heat exchangers using LMTD and NTU methods CO 4 Conduct the experiments on steady state heat conduction through composite planes, composite cylinders, composite spheres, metal rod, insulating powder and liquids. Calculate the temperature distribution and rate of heat transfer. Determine the effectiveness of parallel flow and counter flow heat exchangers. CO 5 Conduct natural convection, forced convection and radiation experiments and Determine rate of heat transfer. Conduct experiments and determine coefficient of performance. of refrigeration, air conditioner. Also determine values of dropwise and film condensation.	
Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.	

Continuous Internal Evaluation:

1. Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2. The class teacher has to decide the topic for closed book test and Written Quiz. In the beginning only teacher has to announce the methods of CIE for the subject.

Semester End Examination:

Theory SEE will be conducted by University as per scheduled time table, with common question papers for subject

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.

Each full question will have sub- question covering all the topics under a module.

TEXTBOOKS:

1. Heat Transfer, Holman J.P., Ninth Edn. Tata McGraw –Hill, 2007
2. Fundamentals of Heat Exchanger Design, Shah, R. K. and Seculic, D. P Wiley India, 2012.
3. Fundamentals of Heat Transfer, Krieth, 4th Edition, Harper & Law, 1986.
4. Heat & Mass Transfer by R.K. Rajput, S. Chand & Co (P) Ltd, 2014
5. Heat & Mass Transfer by S.C.Arora & S. Domkundvar, Dhanapat Rai Co (P) Ltd, 2013.
6. Heat Transfer - A Basic approach by M Necati Ozisik, McGraw Hill International edition 1988
7. Numerical Heat Transfer and Fluid Flow. Hemisphere Publishing Corporation, Taylor and Francis Group New York, 1980.

REFERENCE BOOKS:

1. Principles of Heat and Mass Transfer, Incropera, F.P., Dewitt, D.P., Bergman, T. L. and A. S. Lavine, 7th Ed. (International Student Version), John Wiley & Sons, 2012.
2. Cengel, Y. A. and Ghajar, A. J., "Heat and Mass Transfer", 4th Edn., Tata McGraw Hill Education Pvt. Ltd., New Dehi, 2011.
3. Fundamental of Heat and Mass Transfer, M.Thirumaleshwar, Pearson
4. Computational Heat Transfer and Fluid Flow, Murlidhar & Sunder Rajan, Narosa
5. Thermal Engineering, M.L. Mathur & F.S. Mehta, Jain Publications

MOOC/NPTEL Resources:

1. <http://nptel.ac.in/courses/112101097/>

Course Articulation Matrix :

Course Code / Name : 21ME62 / HEAT TRANSFER

Course Outcomes (CO)	Program Outcomes (PO)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	2			1	1	1						1	3	
CO 2	3	2				1	1							3	
CO 3	3	2				2	2	1					2	3	
CO 4	2	1												2	
CO 5	2	1												2	

1: Low 2: Medium 3: High

DESIGN OF MACHINE ELEMENTS			
Course Code	21ME603	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(2:2:0:0)	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Course Learning Objectives: <ol style="list-style-type: none">1. Understand the concepts of design and various terms connected to design like static strength, fatigue strength, and failure theories.2. Understand the concepts of fatigue under different loading conditions, quantify how the Winkler-Bach theory can be used to analyse the distribution of stresses in crane hooks.3. Understand the design considerations of welded joints under different loading conditions, evaluate the parameters necessary to design different springs.4. Identify the factors to be considered while designing different brakes and clutches.5. Demonstrate the ability to develop designs for different gears, design the shafts for various loading conditions.			
UNIT - I			
Introduction: Meaning of design with special reference to machine design- Definition and understanding of several types of designs. Concept of design, Engineering Materials and their Mechanical properties. Selection of materials, General Design considerations: codes and Standards, Stress Analysis of simple components. Design for Static Strength: Static Strength, Static loads and factor of safety; Theories of failure – Maximum normal stress theory, Maximum shear stress theory, Distortion energy theory. Stress concentration, Determination of Stress concentration factor. Design of simple machines: Crane hook, closed rings and links. Design for Fatigue Strength: Introduction- S-N Diagram, Low cycle fatigue, High cycle fatigue, Endurance limit, Endurance limit modifying factors: size effect, surface effect, Stress concentration effects; Fluctuating stresses, Goodman, Modified Goodman and Soderberg’s relationship; stresses due to combined loading, cumulative fatigue damage.			
			15 Hours
Pedagogy	Chalk and talk method, Power Point Presentation		
UNIT - II			
Welded Joints – Types, Strength of butt and fillet welds, eccentrically loaded welded joints Numerical on welded joints Design of springs: Compression springs, stresses in coil springs of circular and non-circular cross sections, leaf springs - stresses in leaf springs; equalized stresses – energy stored in springs; torsion springs, Belleville springs. Clutches & Brakes: Design of multi plate clutches; design of cone clutch, design of double shoe block brakes, simple and differential band brakes, principle and condition for self-locking of brakes.			
			15 Hours
Pedagogy	Chalk and talk method, Power Point Presentation		
UNIT - III			
Shafts: Torsion of shafts, design for strength and rigidity with steady loading, ASME & BIS codes for design of transmission shafting, shafts under fluctuating loads and combined loads. Design of Gears: Lewis equation, design of a spur gear pair. Helical gears: parallel axis helical gear, normal and transverse planes, helix angles, equivalent number of teeth, design of helical gear pair.			
			10 Hours

Pedagogy	Chalk and talk method, Power Point Presentation
<p>Course outcome (Course Skill Set)</p> <p>At the end of the course the student will be able to :</p> <p>CO 1 Understand the basic concepts involved in machine design and design simple machine components subjected to static loading conditions for different material properties.</p> <p>CO 2 Design simple machine elements subjected to fatigue loading using Goodman and Soderberg design equations, design crane hooks for a given load, cross section using relevant design equations.</p> <p>CO 3 Design welded joints under axial and eccentric loading conditions, Determine the various spring parameters for a specific load, material property, deflection.</p> <p>CO 4 Design plate and cone clutches for a given specification and examine the shoe and band brakes to compute the heat generated and check the possibility of self-locking.</p> <p>CO 5 Design of shafts subjected to Bending, torsional and fatigue loads based on strength and rigidity criterion, Design a pair of spur and helical gears given the number of teeth or pitch circle diameter, pitch line velocity and center distances.</p>	
<p>Assessment Details (both CIE and SEE)</p> <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.</p> <p>Continuous Internal Evaluation:</p> <ol style="list-style-type: none"> 1. Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%). 2. The class teacher must decide the topic for closed book test and Written Quiz. In the beginning only teacher must announce the methods of CIE for the subject. <p>Semester End Examination:</p> <p>Theory SEE will be conducted by University as per scheduled time table, with common question papers for subject</p> <ul style="list-style-type: none"> • The question paper will have eight full questions carrying equal marks. • Each full question will be for 20 marks. • There will be two full questions (with a maximum of four sub- questions) from each module. • Each full question will have sub- question covering all the topics under a module. 	
<p>Suggested Learning Resources:</p> <p>Design Data Hand Book:</p> <ol style="list-style-type: none"> 1. Design Data Hand Book by K. Mahadevan and Balaveera Reddy, CBS Publication, 4th Revised edition (1st January 2013) 2. Lingaiah K., "Machine Design Databook", McGraw Hill, 2nd edition, 2010. <p>TEXTBOOKS:</p> <ol style="list-style-type: none"> 1. Design of Machine Elements: V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition (26th May 2010). 2. Shigley J.E. and Mischke C.R., "Mechanical Engg. Design", McGraw Hill International Edition, 8th Edition, 2010. <p>REFERENCE BOOKS:</p> <ol style="list-style-type: none"> 1. Machine Design: Robert L. Norton, Pearson Education Asia, 5th Edition (16th September, 2013). 2. Design of Machine Elements: M.F.Spotts, T.E. Shoup, L.E. Hornberger, S.R. Jayram and C.V. Venkatesh, Pearson Education, 2006. 3. Machine Design: Hall, Holowenko, Laughlin (Schaum's Outlines series). Tata McGraw Hill Publishing Company Ltd., New Delhi, 2007. 4. Norton R.L., "Machine Design" , Pearson Education Asia, 2012. 5. Hall, Holowenko, Laughlin (Schaum's Outlines series) adapted by Somani S.K., "Machine Design" , Tata McGraw Hill Publishing Company Ltd., New Delhi, Special Indian Edition, 1st Edition, 2011. 6. Ugural A.C., "Mechanical Design of Machine Components", 2nd Edition, CRC Press, Taylor and Francis Group, 2015. 7. Rao T.K., "Design of Machine Elements-Volume II", I.K. International Publishing House Pvt. Ltd., 2010. 	

8. Annaiah M.H., "Design of Machine Elements-II", New Age International Pvt. Ltd., 2nd edition, 2012.
9. Sadhu Singh, "Machine Design" (ISBN: 9789382609575), Khanna Publishing House, Delhi
10. RS Khurmi, "A Textbook of Machine Design", S.Chand Publications

E-BOOKS:

1. Design of Machine Elements by V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2010.
2. Analysis and Design of Machine Elements by V.K Jadon, I.K. International Publishing House Pvt. Ltd., 2010
3. Design of Machine Elements M.F. Spotts, T.E.Shoup, L.E. Hornberger, S.R. Jayaram, C.V. Venkatesh, 8th Edition, Pearson Education, 2006
4. Sharma C.S. and Purohit K., "Design of Machine elements", 9th edition, PHI Learning, 2013.
5. Schmid S.R., "Fundamentals of Machine elements", 3rd edition, CRC Press, 2014.

Web links and Video Lectures (e-Resources):**MOOC/NPTEL resources:**

1. <https://www.mooc-list.com/course/machine-design-part-i-coursera>
2. <http://nptel.ac.in/courses/112105125>

Course Articulation Matrix :**Course Code / Name : 21ME63 / DESIGN OF MACHINE ELEMENTS**

Course Outcomes (CO)	Program Outcomes (PO)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	1	2	3	0	0	0	0	0	1	1	0	1	3	0	0
CO 2	1	2	3	0	0	0	0	0	1	1	0	1	3	0	0
CO 3	1	2	3	0	0	0	0	0	1	1	0	1	3	0	0
CO 4	1	2	3	0	0	0	0	0	1	1	0	1	3	0	0
CO 5	1	2	3	0	0	0	0	0	1	1	0	1	3	0	0

1: Low 2: Medium 3: High

COMPUTER AIDED MODELING AND ANALYSIS LAB			
Course Code	21ME604	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(0:0:2:0)	SEE Marks	50
Total Hours of Pedagogy	30	Total Marks	100
Credits	01	Exam Hours	03
Course Learning Objectives:			
<div>1. Acquire the knowledge about different modules used in ANSYS.</div> <div>2. Determine the unknown variables related to 1-D Bar, and Truss Element using ANSYS software and compare the results with FEM.</div> <div>3. Determine the maximum stress induced due different types of load and varying geometries. Using the concept of machine design and compare the results.</div> <div>4. Determine harmonic frequency.</div> <div>5. Analyze fluid flow problems</div>			
UNIT - I			
<div>1. Study of finite element analysis package (APDL ANSYS 19)</div> <div>2. Static finite element analysis</div> <div>Static finite element analysis of Bars, with constant cross section area, tapered cross section area and stepped bar, Multipoint Constraints, Temperature Stresses in 1D Bars</div> <div>a. Static finite element analysis of different type of Truss element.</div> <div>b. Determining shear force and bending of Beams – Simply supported, cantilever beams with UDL, beams with varying load etc</div> <div>2. Stress analysis of a rectangular plate with a circular hole subjected to both axial and bending.</div> <div>Case study on structural Problem</div> <div>3. Modal and Harmonic analysis.</div> <div>4. Case study on Modal and Harmonic analysis.</div> <div>5. 3D finite element analysis of different structural problems using ANSYS 19 workbench.</div>			
Pedagogy	Chalk and talk method, Power Point Presentation and ANSYS 19 software		
UNIT - II			
<div>1. Thermal Stress analysis of 2D component</div> <div>2. Heat Transfer Analysis – 2D problem with conduction and convection Boundary conditions.</div> <div>3. Fluid flow analysis using ANSYS Workbench</div> <div>4. Case study on thermal and fluid flow problem</div>			
Pedagogy	Chalk and talk method, Power Point Presentation and ANSYS 19 software		
Course outcome (Course Skill Set)			
At the end of the course the student will be able to :			
CO 1 Apply the knowledge of FEM to solve structural problems and verify the results using modern tools (ANSYS)			
CO 2 Apply the knowledge of FEM to solve thermal problems and verify the results using modern tools (ANSYS)			

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student has to obtain minimum of 40% marks individually both in CIE and SEE to pass. Based on this grading will be awarded.

Continuous Internal Evaluation:

1. Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2. The class teacher must decide the topic for closed book test and Written Quiz. In the beginning only teacher must announce the methods of CIE for the subject.

Semester End Examination:

Lab SEE will be conducted by University as per scheduled time table.

- The question paper will have two full questions UNIT -I carrying 30 marks and UNIT -II carrying 10 marks.
- The viva-voce questions carries 10 marks.

Suggested Learning Resources:**TEXTBOOKS:**

1. Finite Element Methods, Daryl L. Logon, Thomson Learning 6th edition, 2015.
2. Introduction to Finite Elements in Engineering, Chandrupatla T. R., 4th Pearson edition, 2014.

REFERENCE BOOKS:

1. The finite element method in Engineering, S S Rao, 5th edition, 2013
2. Introduction to the Finite Element Method, C. S. Desai and J.F. Abel
3. Finite Element Analysis – Theory & Programming, Krishnamoorthy C.S
4. Numerical Methods in Finite Element Analysis, Bathe K. J & E. L Wilson
5. Higher Engineering Mathematics, B. S. Grewal
6. An Introduction to the Finite Element Method J. N. Reddy

Course Articulation Matrix :

Course Code / Name : 21ME66 / COMPUTER AIDED MODELING AND ANALYSIS LAB															
Course Outcomes (CO)	Program Outcomes (PO)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	1	2	3	2	3	1		1	3	1		1	3	0	2
CO 2	1	2	3	2	3	1		1	3	1		1	3	3	2

1: Low 2: Medium 3: High

MINI PROJECT			
Course Code	21ME605	CIE Marks	100
Teaching Hours/Week(L:T:P:S)	-	SEE Marks	-
Total Hours of Pedagogy	-	Total Marks	100
Credits	2	Exam Hours	3
<p>The Mini project work involves the following:</p> <ul style="list-style-type: none"> • The mini project work needs to be completed with a goal to meet the objectives of the course and the topics involving at least one software use for design & analysis would be preferable. • A report highlighting the design finalization [based on functional requirements & standards (if any)] • Fabrication, assembly, testing and performance analysis of the designed project • A presentation including Implementation Phase (Hardware / Software / both), Testing & Validation of the developed system, Learning in the Project and Consolidated report preparation <p>Course Learning Objectives:</p> <ol style="list-style-type: none"> 1. The mini project intends to strengthen the understanding of student's fundamentals through effective application of theoretical and practical concepts. <p>To illustrate, following are some of the suggestions:</p> <ul style="list-style-type: none"> • The mini project work needs to be completed with a goal to meet the objectives of the course as mentioned above. • Topics involving at least one software use for design & analysis would be preferable and students are required to prioritize them during the tenure of the mini project. In the present-day scenario domain-specific jobs requires students to visualize, analyze, and communicate for which project-based learning will be a foundation. • According to type of applications to be solved in Mechanical Engineering, software can be classified into three categories, 1. Mechanical design software, 2. Simulation or analysis software, 3. Artificial Intelligence • Each Student should meet respective guide every week as per time table schedule during the course of the project. A mandatory attendance register shall be maintained by the respective guide/s. Students should maintain a minimum of 75% attendance to get the eligibility for final presentation. <p><u>Course outcome (Course Skill Set)</u></p> <p>At the end of the course student will be able to</p> <p>CO 1 To apply knowledge and skill from selected Engineering areas to solve a practical problem.</p> <p>CO 2 To design and carry out own experiments.</p> <p>CO 3 To design/develop or simulate various engineering applications with the knowledge and skills developed in earlier labs/theory classes.</p> <p>Assessment Details (both CIE and SEE)</p> <p>The internal assessment marks for Mini Project work shall be awarded by giving weightage of 50% to continuous evaluation done during the entire semester and 50% weightage to the final evaluation by the Project Guide/s. Internal assessment would be strictly based on attendance, performance and presentations.</p> <p>Continuous Internal Evaluation:</p> <p>i) Single discipline: Contribution to the project and the performance of each group member shall be assessed individually in Continuous Internal Evaluation (CIE) conducted at the department.</p> <p>ii) Interdisciplinary: Contribution to the project and the performance of each group member shall be assessed individually in Continuous Internal Evaluation (CIE) conducted separately at the departments to which the student/s belong to.</p> <p>Semester End Examination:</p> <p>SCHEME OF EVALUATION:</p> <p>Project demonstration, Viva voce</p> <p>Total marks: 50 Marks</p>			

The distribution of marks shall be proportioned based on the type of the project and it is based on fulfilling the following requisites.

The evaluation of students is proposed to be done by internal faculty. The evaluation may be based on following criteria:

- Punctuality and Attendance " Interpersonal relations
- Sense of Responsibility
- Clarity of concepts, principles and procedures
- Self-expression/communication skills
- Report Writing Skills
- Creativity/conceiving new and unusual ideas
- Problem-solving skills

At the end of the project work course students are required to submit a working model of the equipment they have designed and developed or if it is a theoretical or experimental work, they are expected to study a detailed analysis and findings from their work.

Course Articulation Matrix :

Course Code / Name : 21ME67 / MINI PROJECT															
Course Outcomes (CO)	Program Outcomes (PO)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	1	3	1				1	3	1	2	1	1		
CO 2	2	1	3	1	1			1	3	1	2	1	1	1	
CO 3	2	1	3	1	1			1	3	1	2	1	1	1	
1: Low 2: Medium 3: High															

OPEN ELECTIVE (VI Semester) - 2023-2024

Sl. No.	Code	Name
1.	21MA8X02	Linear Algebra (for all except CS, IS, EC, CCE & AIML)
2.	21HU8X03	Intellectual property rights (for all)
3.	21CV8X07	Environment Impact Assessment (for all except Civil)
4.	21ME8X08	Industrial Pollution Control (for all except Mechanical)
5.	21HU8X24	Professional and Cognitive Communicative (for all)
6.	21ME8X28	Operations Management and Entrepreneurship (for all except Mechanical)
7.	21IS8X38	Introduction to Python Programming (for all except CS & IS)
8.	21BT8X40	Bio Fuel Engineering (for all except BT)
9.	21BT8X42	Solid Waste Management (for all except BT & Civil)
10.	21EC8X59	PCB Design (For all except E&C)
11.	21ME8X63	Innovation & Entrepreneurship (for all)
12.	21HU8X68	Introduction to Yoga (The classes will be conducted from 7.00 a.m. to 8.00 a.m. Those who are willing to come at 7.00 a.m. should only register)
13.	21HU8X70	Overview of Indian Culture and Arts (for all)
14.	21HU8X71	Principles to Physical Education (The classes will be conducted from 5.30 p.m. to 6.30 p.m. Those who are willing to come at 5.30 p.m. should only register)
15.	21HU8X72	Introduction to Japanese language (Students with no backlogs, CGPA should be above 7.0 & who opt to get placed in Japanese companies in Japan/India are eligible to register)
16.	21HU8X74	Introduction to German Language (for all)
17.	21ME8X75	Sustainable Development Goals (for all)
18.	21IS8X76	Web Technologies (for all except CS & IS)
19.	21CS8X77	Programming in Java (for all except EC,CS & IS)
20.	21CS8X78	Data Structures & Algorithms (for all except EC,CS & IS)
21.	21EE8X79	Electric Vehicle Technology (for all except EE)
22.	21HU8X81	National Cadet Corps: Organization, Functions & Capabilities (for only NCC Cadet Students)
23.	21EC8X82	Fundamentals of Image Processing – a practical approach (Only for CV, ME & BT)
24.	21HU8X86	Introduction to Yakshagana (for all - who are familiar with kannada Language)
25.	21ME8X88	Marketing Management (for all except Mechanical)

LINEAR ALGEBRA			
Course Code	21MA8X02	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This course will enable the students to

1. Understand the concepts of vectors, bases.
2. Determine the kernel, range, rank, and nullity of a linear transformation and apply them suitably in their field of study.
3. Find the canonical forms and appraise its importance in various fields.
4. Make use of Gram-Schmidt process to produce an orthonormal basis.
5. Learn the concepts of singular value decomposition and PCA.

UNIT - I

Vector spaces

Vector spaces, subspaces, bases and dimensions, coordinate vectors, null spaces and column spaces of the matrices.

Linear Transformations

15 Hours

UNIT - II

Canonical Forms

Review of characteristic values, similarity of matrices, Cayley Hamilton theorem, annihilating polynomials, invariant subspaces, Jordan and rational canonical forms.

Inner Product Spaces

Inner products; inner product spaces, orthogonal sets and projections, Gram-Schmidt process, QR-factorization, Least-squares problems.

15 Hours

UNIT - III

Symmetric Matrices and Quadratic Forms:

Diagonalization, quadratic forms, constrained optimization, singular value decomposition and principal component analysis. Applications to linear recurrence relations.

09 Hours

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

1.	Interpret vectors in two and three-dimensional spaces both algebraically and geometrically.
2.	Analyze the concept of a linear transformation as a mapping from one vector space to another and be able to calculate its matrix representation with respect to standard and nonstandard bases.
3.	Understand the concepts of Jordan and rational canonical forms.
4.	Make use of Gram-Schmidt process to produce an orthonormal basis and also able to use least square approximation method to obtain the solution of ill conditioned system.
5.	Apply techniques of constrained optimization singular value decomposition and PCA for problems arising in various engineering fields.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												
CO1	3	2										
CO2	2	2										
CO3	3	1										
CO4	3	2										
CO5	3	2										

1: Low 2: Medium 3: High

Mode of Teaching and Learning:
Class room teaching.
Use of mathematical softwares (such as MATLAB, MATHEMATICA, SAGE, ETC.) as teaching aid.

Assessment Details (both CIE and SEE)
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The student must obtain minimum of 40% marks individually both in CIE and SEE to pass. Theory Semester End Exam (SEE) is conducted for 100 marks (3 Hours duration). Based on this grading will be awarded.

Continuous Internal Evaluation:
1. Methods recommended: Two Tests (80%), Written Quiz (10%) and module assignments (10%).
2. The class teacher must decide the topic for closed book test and Written Quiz. In the beginning only teacher must announce the methods of CIE for the subject.

Semester End Examination:
There will be 8 questions of 21 marks each in the question paper categorized into 3 Units as per the syllabi & contact hours. The student will have to answer 5 full questions, selecting 2 full questions each from Unit - I & Unit – II and 1 full question from Unit – III .

TEXTBOOKS:
1. Kenneth Hoffman and Ray Kunze, "Linear Algebra," 2nd edition, Pearson Education (Asia) Pte. Ltd, 2104.
2. David C.Lay, “Linear Algebra and its Applications”, 3 rd edition, Pearson Education (Asia) Pte. Ltd, 2105.

REFERENCE BOOKS:
1. M. Artin , Algebra Prentice Hall of India.2104.
2. Gilbert Strang, “Linear Algebra and its Applications”, 4th edition, Thomson Learning Asia, 2103.
3. Bernard Kolman and David R. Hill, “Introductory Linear Algebra with Applications”, Pearson Education (Asia) Pte.Ltd 7 th edition ,2103.
4. Sheldon Axler, “Linear Algebra Done Right”, Springer International Publication, Third Edition,2115.

INTELLECTUAL PROPERTY RIGHTS			
Course Code	21HU8X03	Course Type	OEC
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Credits	03
Total Teaching Hours	39+0+0	CIE + SEE Marks	50+50
Teaching Department: Humanities			
Course Learning Objectives:			
1.	Understand the creativity component in intellectual property, different types of legal protection of intellectual properties and other basic concepts of Intellectual property.		
2.	Analyze different types of protection for inventions, different types of agreements and treaties for Intellectual properties with an ability to examine patent types, specifications and patent search and database for 'prior art'.		
3.	Understand the basic procedure of drafting claims, apply for patents, other legal forms of intellectual property rights and also to examine the protocol involved in protection of inventions like patents.		

UNIT - I

Invention and Creativity - Intellectual Property (IP) – Importance, Jurisprudential definition and concept of property, rights, duties and their correlation; History and evaluation of IPR – like Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications.

8

History - General Agreement on Trade and Tariff (GATT). Indian Position vis-a-vis WTO and Strategies; TRIPS Agreement; Madrid Agreement; Hague Agreement; WIPO Treaties; International convention relating to Intellectual Property - Establishment of WIPO - Mission and Activities – Budapest Treaty; PCT; Indian Patent Act 1970 & recent amendments – Patent (Amendment) Rules, 2017

8

<p>Basics of Patents and Concept of Prior Art</p>	
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Introduction to Patents; Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; Specifications: Provisional and complete; Forms and fees Invention in the context of “prior art”; Patent databases; Searching International Databases; Country-wise patent searches (USPTO, EPO, WIPO, IPO, etc.)

8

National & PCT filing procedure; Time frame and cost; Status of the patent applications filed; Structure of Patent document, Precautions while patenting – disclosure/non-disclosure; Financial assistance for patenting - introduction to existing schemes; Patent licensing and agreement; Patent infringement- meaning, scope, litigation, case studies

8

<p>Case Studies:</p>	
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Patents: Biological Cases - i) Basmati rice ii) Turmeric iii) Neem; Non-biological cases – (i) TVS V/S Hero, (ii) Samsung V/S Nokia – Copyright and related rights – Trade Marks – Trade secrets - Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition; Technology transfer and license agreements (US anti-HIV drug license to Africa)

7

1.	Have a General understanding of the Intellectual Property Rights.
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1.	Have a General understanding of the Intellectual Property Rights.
2.	Have awareness of different forms of intellectual property rights, national and international IPR related legislations.
3.	Have a general understanding about the provisions, privileges and limitations of intellectual property right holders with an understanding of the legal aspects (civil or criminal) of the use of intellectual property rights.
4.	Acquire Knowledge of National and International Trade Agreements and Agencies functioning in relation to intellectual property rights
5.	Be aware and have a general understanding of patenting procedures and licensing.

	Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO	
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Program Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	100%	
↓ Course Outcomes													1	2
CO1		3	3	2		3			2	2		3		
CO2	2	2	3			3		3	1	1	2	2		
CO3	2			2		3			2	2	2	3		
CO4			1	1		3			1	2		3		
CO5	3	2	1			3			3	1		2		

1: Low 2: Medium 3: High

1.	BAREACT Indian Patent Act 1970 Acts & Rules Universal Law Publishing Co. Pvt. Ltd. 2107
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1.	BRUNER, J., Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 2107
2.	Kankanala C., Genetic Patent Law & Strategy, 1st Edition, Manupatra Information Solution Pvt. Ltd., 2107
3.	Subbaram N.R. "Handbook of Indian Patent Law and Practice", S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.
4.	Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
5.	Intellectual Property Today: Volume 8, No. 5, May 2101,
6.	WTO and International Trade by M B Rao. Vikas Publishing House Pvt. Ltd.
7.	Correa, Carlos M. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and

	policy options, Zed Books, New York 2100
8.	Wadehra, B. L. Law relating to patents, trademarks, copyright designs & geographical indications 2 ed. Universal Law Publishing 2100
9.	Sinha, Prabhas Chandra Encyclopedia of Intellectual Property Rights, 3 Vols. Eastern Book Corporation, 2106.
10.	“Practical Approach to Intellectual Property Rights”; Rachna Singh Puri and Arvind Vishwanathan, I. K. International Publishing House Pvt. Ltd.
E-RESOURCES:	
1.	http://www.w3.org/IPR/
2.	http://www.wipo.int/portal/index.html.en
3.	http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html
4.	www.patentoffice.nic.in
5.	www.iprlawindia.org/

ENVIRONMENTAL IMPACT ASSESSMENT			
Course Code	21CV8X07	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This Course will enable students to

1. Identify the need to assess and evaluate the impact of projects on environment.
2. Explain major principles of environmental impact assessment.
3. Understand the different steps within environmental impact assessment.
4. Appreciate the importance of EIA for sustainable development and a healthy environment.

UNIT – I

Evolution of EIA: Concepts of EIA, EIA methodologies (Adhoc, Network Analysis, Checklists, Map overlays, Matrix method), Screening and scoping, Rapid EIA and Comprehensive EIA, General Framework for Environmental Impact Assessment, EIA Specialized areas like environmental health impact assessment, Environmental risk analysis.

16 Hours

UNIT - II

Baseline data study, Prediction, and assessment of impacts on physical, biological, and socio-economic environment, Legislative and environmental clearance procedures in India, Public participation, Resettlement, and rehabilitation.

10 Hours

UNIT – III

Fault free analysis, Consequence Analysis, Introduction to Environmental Management Systems, Environmental management plan-Post project monitoring Environmental Audit: Cost Benefit Analysis, Life cycle Assessment. Case studies on project, regional and sectoral EIA.

13 Hours

Course Outcomes:

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

1. Understand phenomena of impacts and know the impact quantification of various projects in the environment.
2. Liaise with and list the importance of stakeholders in the EIA process.
3. Know the role of public in EIA studies.
4. Overview and assess risks posing threats to the environment.
5. Assess different case studies/examples of EIA in practice.

Course Articulation Matrix :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1				2	3	2					2	3	
CO2	1	1				2	3	2					2	3	
CO3	1	1				2	3	2					2	3	
CO4	1	1				2	3	2		3			2	3	
CO5	1	1		3		2	3	2				3	2	3	

Note:- 1:Low 2:Medium 3: High

TEXTBOOKS:

1. Noble, L. 2110. Introduction to environmental impact assessment. A Guide to Principles and Practice. 2nd edition. Oxford University Press, Don Mills, Ontario.
2. Larry W. Canter, Environmental Impact Assessment, McGraw Hill Inc. Singapore, 1996

ADDITIONAL REFERENCE MATERIALS

1. Morris and Therivel, 2109. Methods of Environmental Impact Assessment, 3rd edition. New York, NY: Routledge.
2. Hanna, K.S. 2109. Environmental impact assessment. Practice and Participation. 2nd edition. Oxford, University Press, Don Mills, Ontario.

NPTEL SOURCES

<http://nptel.ac.in/courses/121108004/>

<http://nptel.ac.in/courses/121108004/module3/lecture3.pdf>

INDUSTRIAL POLLUTION CONTROL			
Course Code	21ME8X08	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives: This Course will enable students to,	
1	Know the Consequences of pollution, relationship between man and environment over the last few decades, necessity of modern awareness on pollution and how carbon audit can help in developing a carbon strategy.
2	Identify the Importance of Meteorology in pollution control and global warming, various types of plume dispersions and its effect; analyze various levels of plume height for different pollutants.
3	Distinguish Particulates and fly ash separation techniques such as cyclone separator, electrostatic precipitator efficiency calculations etc.
4	Illustrate Formation, measurement and control techniques for Smoke and gaseous pollutants.
5	Summarize the Effects of water, soil, plastics and odor pollution their control techniques, Different Pollution Control Acts, Legal aspects of pollution control and how these acts can help in bringing down the pollution rate.
UNIT - I	
Introduction to Pollution	
Man and the environment, types of pollution and its consequences, Changing environmental management concept, sustainable industrial growth, carbon audit, Ill effects of various pollutants, permissible concentration levels & AQI.	
Meteorology	
Meteorology, Wind rose, Lapse rate, plume dispersion studies & Numerical problems	
15 Hours	

UNIT - II	
Separation techniques	Different types of Particulates, Need for Separation techniques, Sources of Particulates Matter Fly Ash Electrostatic precipitator (Problems) Theory of settling processes (Design Problems), Bag House fabric filter Cyclone separator Spray Tower Scrubbers & Venturi Scrubber
Smoke and gaseous pollutants	Smoke- White, blue and black smoke, Sources of smoke, T,T,T-O Principle of smoke Measurement of stack smoke intensity using Ringlemann Chart and Smokescope & Bosch Smoke meter, Domestic and Industrial Incinerators-Design factors, Pollutant gaseous So ₂ , Co, UBHC, Nox their ill effects and & control methods..
15 Hours	
UNIT - III	
Water, soil, noise, and odor pollution, their control methods, problems associated with nuclear reactors, Legal aspects of pollution control in India, brief details of Euro and BS standards.	
9 Hours	

Course Outcomes:

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

CO 1	Identify the various types of pollutants and distinguish between them with regards to Particulate matters and AQI.
CO 2	Outline the instruments for Meteorological measurements, distinguish types of plume dispersions and its effect; analyze the concentration of various gaseous pollutants from T-Z diagrams.
CO 3	Explain the Particulates and fly ash separation techniques, compare and Interpret their efficiency.
CO 4	Illustrate Formation, measurement and control techniques for Smoke and gaseous pollutants
CO 5	Identify Effects of water, soil, plastics and odor pollution on environmental Pollution and explain the Legal aspects of pollution control.

TEXTBOOKS:

1. "Environmental Pollution Control Engineering, Wiley Eastern Ltd.,
2. "Introduction to Environmental Engineering & Science", Gilbert M Masters, PHI,1995
3. "Environmental Pollution Control Engineering, C. S RAO New Age Int.

REFERENCE BOOKS:

1. "Air Pollution", Henry C. Perkins, Mc-Graw Hill, 1974.
2. "Air Pollution control", W. L. Faith, John Wiley

MOOC/NPTEL Resources:

1. <http://nptel.ac.in/courses/105106119/36>

Course Articulation Matrix

Course Code / Name : 21ME8X08/ Industrial Pollution Control														
Course Outcomes (CO)	Program Outcomes (PO)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C-21ME8X08.1	2								1	1		1		
C-21ME8X08.2	2								1	1		1		
C-21ME8X08.3	2								1	1		1		
C-21ME8X08.4	2								1	1		1		
C-21ME8X08.5	2								1	1		1		

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I** & **Unit – II** and **1** full question from **Unit – III**.

PROFESSIONAL & COGNITIVE COMMUNIQUÉ			
Course Code	21HU8X24	Course Type	OE
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Credits	03
Total Teaching Hours	39+0+0	CIE + SEE Marks	50+50
Teaching Department: Humanities			
Course Learning Objectives:			
1.	To Problematize Commonsense & Apply Critical thinking skills		
2.	Comprehend etiquettes and manners in different situations		
3.	Be gender sensitive in both offline and online behavior		
4.	Exhibit better comprehension of the social implications of human body		
5.	Understand the importance of reading and writing skills		
UNIT - I			
Common sense and Emotional Intelligence Common sense, Commonsensical Consensus, Critical thinking, Unsettling commonsensical Consensus, Role of language in Common sense and Critical Thinking; Nature & Functions of Emotional Intelligence, Emotions, Intelligence and Creativity, Growth of Emotional Intelligence			15
Etiquettes & Workplace Etiquette, Workplace Etiquettes, Workplace Readiness Skills, Significance of Cross-Cultural Understanding; Cultural Sensitivity, Impact of social media in Workplace			
UNIT - II			
Social Networking Sites and its Impacts Emergence of social media, Impact on Gender and Self Representation, Regulatory and Liberatory aspects of social media, Offline Norms & Online Behaviour			15
Gender and Body Gender & Sex, Genderization, Homogeneity and Heterosexuality, Gender Expressions, Gender Schooling, Representations of Body, Objectification, Gender Perspectives of Body, Different Ways of Seeing the Body, Discipline & Coercion, ISA & RSA			
UNIT - III			
Writing Types of Writing, Note Taking Methods, Plagiarism Reading Styles of Reading, Types of Reading, Scanning, Skimming			9

Course Outcomes: At the end of the course student will be able to															
1.	Problematize Commonsense & Apply Critical thinking skills														
2.	Comprehend etiquettes and manners in different situations														
3.	Be gender sensitive in both offline and online behavior														
4.	Exhibit better comprehension of the social implications of human body														
5.	Understand the importance of reading and writing skills														
Course Outcomes Mapping with Program Outcomes & PSO															
	Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
	↓ Course Outcomes													1	2
	CO1		3							3	3		3		
	CO2		2						3	2	3		2		
	CO3		3							2	2		3		
	CO4		3							2	2		3		
	CO5		2							3	3		2		
1: Low 2: Medium 3: High															
REFERENCE MATERIALS:															
1.	Geetha.V. Gender. Kolkatta: Web Impressions, 2109.														
2.	Bailey, Jane, et al. "Negotiating with Gender Stereotypes On Social Networking Sites: From "Bicycle Face" to Facebook." Journal of Communication Enquiry 37.2 (2113): 91-112.														
3.	Barry, Peter. Beginning Theory. New Delhi: Viva Books, 2110.														
4.	Berger, John. Ways of Seeing. London: Penguin Books, 1977.														
5.	Cranny-Francis, Anny, et al. Gender Studies: Terms and Debates. New York: Palgrave Macmillan, 2103.														
6.	Gauntlett, David. Media, Gender and Identity: An Introduction. London: Routledge, 2108														
7.	Pilcher, Jane, and Imelda Whelehan. 50 Key Concepts in Gender Studies. London: Sage, 2104. Print.														
8.	Jeanne, Haraway Donna. Simians, Cyborgs, and Women. London: Free Association Books, 1991. Web.														
9.	Koskela, Hille. "Webcams, TV Shows and Mobile Phones: Empowering Exhibitionism." Surveillance & Society 2.3 (2104): 199-215.Web.														
E-RESOURCES:															
1.	http://www.cyberpsychology.eu/view.php?cisloclanku=2109061501/ >.														
2.	http://www.surveillance-and-society.org/articles2(2)/webcams.pdf														
3.	http://eprints.rclis.org/19790/ >.														

OPERATIONS MANAGEMENT & ENTREPRENEURSHIP				
Course code		21ME8X28	CIE Marks	50
Teaching Hours/Week (L:T:P)		(3:0:0)	SEE Marks	50
Total Hours		39	Credits	03
Course Learning Objectives: This Course will enable students to,				
1	Define production/operations management, Classify Production and service system and different type of production systems, Understand the importance of CRM and ERP			
2	Appreciate the importance of Quality tools and methods in operations management			
3	Analyze the data draw variable process control charts and determine process capability; Understand salient issues concerning reliability			
4	Understand the issues related to entrepreneurship, characteristics of an entrepreneur and different studies carried out during project appraisal.			
5	Identify and differentiate the different national and state level funding agencies.			
UNIT – I				
Introduction to Production/ Operations Management: Concept of production, Classification of production systems, Production Management, Concept of operations, Distinction between Manufacturing Operations and Service Operations, Objectives of Operations Management (Customer Service and Resource utilization/ Competitive advantage through Quality-Delivery-Cost), Scope of Operations Management. Introduction to				

Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP).	
7 Hours	
Introduction to Quality Concepts: The Meaning of Quality and Quality Improvement, Key dimensions of Quality, Concept of cost of quality. Customers' perception of quality.	
TOTAL Quality Management: Definition, Principles of TQM, Gurus of TQM, Benefits of TQM.	
Managing Quality: Quality circles, Continuous Improvement- Juran's Trilogy, PDSA cycle, Kaizen, 7 QC tools,	
Philosophy of statistical process control and modeling process quality: Normal distribution tables, Finding the Z score, Central limit theorem, Chance and assignable causes of variation, Statistical Basis of the Control Charts (basic principles, choices of control limits, significance of control limits, warning limits)	
9 Hours	
UNIT – II	
Control charts for variables: Control Charts for X-Bar and R- Charts, Type I and Type II errors, Simple Numerical Problems,	
Process capability: The foundation of process capability, Natural Tolerance limits, c_p – process capability index, c_{pk} , p_p – process performance index, summary of process measures. Numerical problems. Concept of Six sigma.	
Introduction to reliability, Mean time to failure, Mean time between failures, Bath tub curve, Reliability of series and parallel systems, Numerical problems on the above topics.	
8 Hours	
Entrepreneurship: Concept of Entrepreneurship, Stages in entrepreneurial process, Role of entrepreneurs in Economic Development, Barriers to Entrepreneurship, Meaning of Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneurs, Intrapreneur - an emerging Class.	
Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.	
Application of Operations Management concepts in Facility/ Business Location: General procedure for making locations decisions, Numerical Problems on application of Breakeven analysis and Transportation method to make location decisions.	
8 Hours	
UNIT – III	
Small scale industries: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI, Steps to start and SSI, Government policy towards SSI; Different Policies of SSI, Impact of Liberalization, Privatization, Globalization on SSI. Effect of WTO/GATT on SSI, Supporting Agencies of Government for SSI, Ancillary Industry and Tiny Industry (Definition Only)	
Institutional Support: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC.	
7 Hours	

Course Outcomes (CO)

CO 1	Differentiate production and service systems. Discuss continuous and intermittent production systems with their advantages and disadvantages. Discuss CRM and ERP systems.
CO 2	Discuss Total Quality Management tools and methods. Solve problems on fundamentals of statistics and normal distribution.
CO 3	Draw and Analyze variable process control charts and determine process capability. Calculate reliability of series and parallel systems using the information on failure rate and time.
CO 4	Discuss entrepreneurship, characteristics of an entrepreneur and barriers to entrepreneurship. Discuss the elements of a project report and feasibility studies conducted in the project appraisal.
CO 5	Identify and differentiate the national and state level funding agencies. Discuss the effect of GATT and WTO on Indian economy.

TEXTBOOKS:

- Production / Operations Management**, Joseph G Monks, McGraw Hill Books
- Production and Operations Management**, William J Stevenson, Tata McGraw Hill, 8th Edition.
- Statistical Quality Control**: RC Gupta, Khanna Publishers, New Delhi, 2105.
- Total Quality Management**: Dale H. Besterfield, Pearson Education, 2103.
- Dynamics of Entrepreneurial Development & Management** – Vasant Desai – Himalaya Publishing House
- Entrepreneurship Development** – Poornima.M.Charantimath – Small Business Enterprises – Pearson Education – 2106 (2 & 4).

REFERENCE BOOKS:

1. **Statistical Quality Control:** E.L. Grant and R.S. Leavenworth, 7th edition, McGraw- Hill publisher.
2. **Statistical Process Control and Quality Improvement:** Gerald M. Smith, Pearson Prentice Hall. ISBN 0 – 13-049036-9.
3. **Statistical Quality Control for Manufacturing Managers:** W S Messina, Wiley & Sons, Inc. New York, 1987
4. **Statistical Quality Control:** Montgomery, Douglas, 5th Edition, John Wiley & Sons, Inc. 2105, Hoboken, NJ (ISBN 0-471-65631-3).
5. **Principles of Quality Control:** Jerry Banks, Wiley & Sons, Inc. New York.
6. **Entrepreneurship Development** – S.S.Khanka – S.Chand & Co.

MOOC/NPTEL Resources:

1. <http://nptel.ac.in/courses/110105067/>
2. <https://www.edx.org/course/operations-management-iimb-om101-1x>

Course Articulation Matrix

Course Code / Name: 18ME8X28/ Operations Management & Entrepreneurship															
Course Outcomes (CO)	Program Outcomes (PO)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C-21ME8X28.1	3	1	0					1	1	1	1				
C-21ME8X28.2	1	2	0						1	1	3				
C-21ME8X28.3	2	2	0				1	0	1	1	3				
C-21ME8X28.4	3	1	0			1	0	1	1		2				
C-21ME8X28.5	1	1	0			1	1	1	1		3				

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I** & **Unit – II** and **1** full question from **Unit – III**.

INTRODUCTION TO PYTHON PROGRAMMING			
Course Code	21IS8X38	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Prerequisites:

Student must have fundamental knowledge of procedure-oriented programming.

Course Learning Objectives (CLOs):

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

- Construct Python programs using data types and looping.
- Design object-oriented Python programs using classes and objects.
- Design useful stand-alone and CGI applications in Python.

UNIT - I

INTRODUCTION: Introduction to python, Installing Python; basic syntax, interactive shell, editing, saving, and running a script. The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages. Conditions, Boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation.

STRING MANIPULATIONS: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa, Binary, octal, hexadecimal numbers

LISTS, TUPLES, AND DICTIONARIES: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries.

15 Hours

UNIT – II

FUNCTIONS: Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments. Program structure and design. Recursive functions

CLASSES AND OOP: Classes, objects, attributes and methods; defining classes; design with classes, data modelling; persistent storage of objects, inheritance, polymorphism, operator overloading (`_eq_`, `_str_`, etc); abstract classes; exception handling, try block

15 Hours

UNIT – III

FILE HANDLING: Manipulating files and directories, Reading from Text Files, Writing to Text Files, Reading from Binary Files, Writing to Binary Files, Seeking Within Files, Creating and Reading a formatted file (csv or tab-separated).

GRAPHICAL USER INTERFACES: event-driven programming paradigm; creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames Simple CGI form

9 Hours

Course Outcomes:

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
C8X38.1	Demonstrate the basics of Python programming like data types and looping	L2
C8X38.2	Apply the basic data structures in solving the problems	L3
C8X38.3	Experiment with usage of functions in a given problem	L3
C8X38.4	Develop Objects by creating classes and apply object-oriented features	L3
C8X38.5	Develop applications in Python using File Programming & User Interface	L3

Table: Mapping of COs to PIs, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,2,3	1.4.1,1.3.1,2.1.1,2.1.2,2.2.4,3.1.1	L2
CO2	1,2,3	1.4.1,1.3.1,2.3.1,3.1.1,3.2.2	L3
CO3	1,2,3	1.4.1,1.3.1,2.1.1,2.1.2,2.2.4,3.1.1,3.1.6,3.2.1,3.2.2	L3
CO4	1,2,3	1.4.1,1.3.1,2.1.1,2.1.2,2.2.4,3.1.1,3.1.6,3.2.1,3.2.2	L3
CO4	1,2,3	1.4.1,1.3.1,2.1.1,2.1.2,2.2.4,3.1.1,3.1.6,3.2.1,3.2.2	L3

Mapping Course Outcomes with Programme Outcomes:

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C8X38.1	1	2	1											
C8X38.2	1	2	1										2	2
C8X38.3	1	2	2										2	3
C8X38.4	1	2	2										2	3
C8X38.5	1	2	2										2	3

(L/1=Low30%-49%,M/2=Medium50%-69%,H/3=High>70%)

TEXTBOOK:

- 1) Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2111, Cengage Learning, ISBN: 978-1111822705

ADDITIONAL RESOURCES:

1. Think Python. PDF is free.

SEE Question Paper Pattern:

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit - II** and **1** full question from **Unit - III**.

BIOFUEL ENGINEERING			
Course Code	21BT8X40	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Prerequisites: Nil

Co-requisites: Nil

Course Learning Objectives:

The objective of this course is

- To learn the fundamental concepts of biofuels, types of biofuels, their production technologies.
- To learn the concepts of feedstock utilization and energy conversion technologies.

UNIT – I**LIQUID BIOFUELS**

Description and classification of Biofuels; Primary biomass: Plant materials-Woody biomass, Lignocellulosic and agroindustrial by-products, starchy and sugary crops. Secondary biomass: Waste residues and co-products-wood residues, animal waste, municipal solid waste. Biomass production for fuel – algal cultures, yeasts (Lipid and carbohydrate).

Production of biodiesel: Sources of Oils – edible and non edible; Esterification and Transesterification. Free fatty acids; saponification; Single step and two step biodiesel production. Catalysts for biodiesel production – homogeneous (alkali/acidic) and heterogeneous; Lipase mediated process. General procedure of biodiesel production and purification Quality Control Aspects: GC analysis of biodiesel, fuel property measurements, ASTM (D-6751) and Indian standards (IS15607). Algal Biodiesel production.

Production of Bioethanol: Bioethanol production using Sugar; Starch and Lignocellulosic feedstocks; Pretreatment of lignocellulosic feed stock

15 Hours

UNIT – II**BIOHYDROGEN AND MICROBIAL FUEL CELLS**

Enzymes involved in H₂ Production; Photobiological H₂ Production: Biophotolysis and Photofermentation; H₂ Production by Fermentation: Biochemical Pathway, Batch Fermentation, Factors affecting H₂ production, Carbon sources, Detection and Quantification of H₂. Reactors for biohydrogen production.

Microbial Fuel cells: Biochemical Basis; Fuel Cell Design: Anode & Cathode Compartment, Microbial Cultures, Redox Mediators, Exchange Membrane, Power Density; MFC Performance Methods: Substrate & Biomass Measurements, Basic Power Calculations, MFC Performance: Power Density, Single vs Two-Chamber Designs, Wastewater Treatment Effectiveness; Advances in MFC.

15 Hours

UNIT – III**RECOVERY OF BIOLOGICAL CONVERSION PRODUCTS**

Biogasification of municipal solid waste: Anaerobic processing; Types of digesters, Biogas plant in India.

Thermochemical processing: Planning an incineration facility, Incineration technologies: Mass burning system; Refuse derived fuel (RDF) system; modular incineration; Fluidized bed incineration; energy recovery; Fuel production through biomass incineration, Pyrolysis and gasification, hydrothermal processing.

9 Hours

Course Outcomes:

At the end of this course, student should be able to:

1. Mark the significance of biofuels and raw materials and Identify suitable feedstock for production of biofuels.
2. Illustrate the production of liquid biofuels from various feed stocks.
3. Demonstrate production of biohydrogen using microbial sources.
4. Extend the concepts of microbial fuel cells towards development of specific application.
5. Understand and apply the concepts of biochemical processing to harvest energy from waste products/streams.

Mapping of POs & COs:

	PO											
CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1		M							L			
CO2		M							L			
CO3		M							L			
CO4		M							L			
CO5		M							L			

REFERENCE BOOKS:

1. Drapcho, C. M., Nhuan, N. P. and Walker, T. H. *Biofuels Engineering Process Technology*, Mc Graw Hill Publishers, New York, 2108.
2. Jonathan R.M, *Biofuels – Methods and Protocols (Methods in Molecular Biology Series)*, Humana Press, New York, 2109.
3. Olsson L. (Ed.), *Biofuels (Advances in Biochemical Engineering/Biotechnology Series)*, Springer-Verlag Publishers, Berlin, 2107.
4. Glazer, A. and Nikaido, H. *Microbial Biotechnology – Fundamentals of Applied Microbiology*, 2 Ed., Cambridge University Press, 2107.
5. Godfrey Boyle (Ed). *Renewable Energy- Power for sustainable future*, 3rd Ed. Oxford. 2112.
6. Ramachandran, T. V. *Management of municipal solid waste*. Environmental Engineering Series. Teri Press, 2116.

SEE QUESTION PAPER PATTERN:

Unit No.	I	II	III
Questions to ask (21 marks/Qn)	3	3	2
Questions to answer	2	2	1

SOLID WASTE MANAGEMENT			
Course Code	21BT8X42	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Prerequisites: Nil

Co-requisites: Nil

Course Learning Objectives:

The objective of this course is

1. To learn types of solid wastes, collection, treatment and disposal methods.
2. To understand various processing techniques and regulations of treatment and disposal.

UNIT – I

INTRODUCTION TO SOLID WASTES AND ITS SEGREGATION & TRANSPORTATION

Solid waste – Definition, Sources of waste, Classification of Solid waste, Characteristics of Solid Waste (Physical, Chemical, Biological), Solid waste problems – impact on environment and health. Concept of waste reduction, recycling and reuse.

Waste collection and segregation: Solid waste generation, Onsite handling and segregation of wastes at source, Collection and storage of municipal solid wastes, Equipment used and manpower required in collection, Collection systems and routes.

Transportation: Transfer stations: types, location, maintenance, Methods and means of transportation.

15 Hours

UNIT – II

PROCESSING TECHNIQUES, RECOVERY OF RESOURCES AND WASTE DISPOSAL

Processing Techniques: Unit operations for separations and processing, mechanical and thermal volume reduction, Incineration of solid wastes – process and types of incinerators (liquid injection, rotary kiln and fluid bed), Biological processing – composting, vermicomposting, biomethanation, fermentation, Drying and dewatering of wastes.

Recovery of Resources: Heat recovery in incineration process, energy recovery and conversion of products from biological processes.

Dumping of solid wastes, Landfills – Types, site selection, preliminary design, operation, case study, Advantages and disadvantages of landfills, Leachate and landfill gases: Collection and treatment, Landfill disposal for hazardous wastes, biomedical waste.

16 Hours

UNIT – III

SOLID WASTE MANAGEMENT RULES AND PLANNING ISSUES

Legislative trends and impacts: Major legislations, Government agencies. Municipal Solid Waste Management Act (1999), Hazardous Wastes (Handling and Management) Rules, Biomedical Waste (Handling and Management) Rule (1998), e-Waste (Management and Handling) Rule 2011.

Planning and developing a site for solid waste management, Site Remediation: Assessment and Inspection, Remedial techniques, Siting guidelines.

8 Hours

Course Outcomes:

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

1. Identify the sources, classification and characteristics of solid wastes
2. Develop insight into the collection, transfer, and transport of solid waste.
3. Apply waste processing techniques and recovery of resources from the waste.
4. Select the alternatives of solid waste disposals and its impacts.
5. Acquire knowledge about solid and hazardous waste management legislative rules.

Mapping of POs & COs:

	PO											
CO	1	2	3	4	5	6	7	8	9	10	11	12
CO1	L								L			
CO2	L	L				L	L		L			
CO3		M							L			
CO4		M				L	L		L			
CO5	L								L			L

REFERENCE BOOKS:

1. Tchobanoglous, G., Theisen, H. and Vigil, S. A. *Integrated Solid Waste Management*, McGraw – Hill, 1993.
2. Tchobanoglous, G., Thiesen, H., Ellasen, *Solid Waste Engineering Principles and Management*, McGraw – Hill, 1997.
3. Landrefh, R. E. And Rebers, P. A. Lewis, *Municipal Solid Wastes-Problems & Solutions*, 1997.
4. Bhide, A. D. and Sundaresan, B. B. *Solid Waste Management in Developing Countries*, Indian National Scientific Documentation Centre. New Delhi, 2100.

SEE QUESTION PAPER PATTERN:

Unit No.	I	II	III
Questions to ask (21 marks/Qn)	3	3	2
Questions to answer	2	2	1

PCB DESIGN			
Course Code	21EC8X59	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Pre-requisites:

Basic electrical and electronics engineering.

Course Learning Objectives:

1. To enable students to gain knowledge of Schematic Design techniques & PCB design techniques
2. To expose students to complete PCB Design & manufacturing process

List of Experiments

- Introduction to PCB design tool: building a schematic circuit and layout
- Exploring the PCB design tool by creating new components, using existing components and footprint, simulation features, Active & Passive Components
- Drawing a PCB layout in a single layer with constraints such as board area, track width, packages, via etc
- Creating a double layer PCB for a given schematic circuit
- Creating and using different component package types
- Fabrication of single and double layer PCB on a copper clad board using hatching/engraving technique.
- Handling PCB prototype machine using Mach3 CNC tool for the PCB prototype.

Detailed Course Plan**Lab 1**

Introduction to PCB design tool : building a schematic circuit.

Lab 2

Creating Library & Components, using existing components and footprint, simulation features, Active & Passive Components.

Lab 3

Designing a single layer PCB for given schematic circuit diagram, Gerber file generation.

Lab 4

Designing a double layer PCB for given schematic circuit diagram, Gerber file generation.

Lab 5

Simulating digital and analog circuits for given test cases.

Lab 6

Handling programmable microcontroller circuit in the simulation environment of schematic editor .

Lab 7

Defining a footprint for a component in the PCB layout.

Lab 8

Fabrication of single layer PCB using PCB prototype machine – Generating bit file in Copper Cam tool.

Lab 9

Fabrication of single layer PCB using PCB prototype machine – Setting up Mach3 CNC tool.

Lab 10

Fabrication of double layer PCB using PCB prototype machine – Generating bit file in Copper Cam tool.

Lab 11

Fabrication of double layer PCB using PCB prototype machine -Setting up Mach3 CNC tool.

Lab 12

Component placement and soldering.

Lab 13

Desoldering and testing.

Scheme of SEE Examination

It is a 3-Hour exam at the end of the semester where the student is to demonstrate the PCB designing process.

Sl.No	Activity	Max. Marks
1	Creating schematic for a given circuit diagram	15
2	PCB Layout design	21
3	Setting up fabrication	15
Total		50

Course Outcomes:

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

1. Draw schematic circuit and create PCB layout for single or multilayer PCB
2. Fabricate single and double-layer PCB using Mach3Mill operated CNC machine.

INNOVATION AND ENTREPRENEURSHIP			
Course Code	21ME8X63	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Prerequisites:

The student must have learnt basics of Engineering concepts, applications and business as a whole.

Course Learning Objectives: This Course will enable students to,

1	Understand Technological Innovation
2	Understand Innovation management and the difference between Invention and Innovation.
3	Appreciate the importance of Innovation as management process and Innovation management techniques.
4	Define Innovation system and Understand the importance of Technology management and Transfer.
5	Identify Technological Entrepreneurship and its types and Understand the Institutional support provided for Entrepreneurs

UNIT – I**INTRODUCTION TO TECHNOLOGICAL INNOVATION****14 Hours**

Basic Concepts and Definitions: Technology - Technology Management – Invention – Creativity – Innovation - The Concept of Technological Innovation - Innovation Posture, Propensity and Performance - Innovation Measurement - Key factors linking creativity and innovation – Classifications of Innovations – Innovation Process.

INTRODUCTION TO INNOVATION MANAGEMENT

Innovation Management Through Management of Knowledge and Education – Types of Learning - Difference Between Innovation and Invention - Types and Characteristics of Innovation.

INNOVATION AND COMPETITIVENESS

Case Study – Barriers for Innovation and Competitiveness.

UNIT – II	
INNOVATION AS A MANAGEMENT PROCESS	14 Hours
Activities to enhance companies capacity for innovation – Management of Technological Innovation: Corporate Perspective, National Perspective, Theoretical Perspective and Individual Perspective - Challenges in Technological Innovation Management - Case Study in Technological Innovation Management - Innovation Management Techniques (IMTs).	
INNOVATION SYSTEMS	
The Concept of Innovation Systems - Innovation Systems: Sectoral, Regional, National.	
TECHNOLOGY MANAGEMENT AND TRANSFER	
Technology Transfer - Impacts of MNCs in technology transfer -	
UNIT – III	
INTRODUCTION TO TECHNOLOGICAL ENTREPRENEURSHIP	11 Hours
Types of Entrepreneurship: Mixed Entrepreneurship, Pure Entrepreneurship, Social Entrepreneurship, Collaborative Entrepreneurship, Internal Entrepreneurship, External Entrepreneurship - Sustainable Entrepreneurship -	
INSTITUTIONAL SUPPORT	
Business Incubator (Bi) - Determination of the Five Incubator Services - Incubation Centres in India – Atal Incubation Centre – Startup India - NSIC, KIADB, KSFC.	

Course Outcomes (CO):	
At the end of the course the student will be able to,	
CO 1	Describe technological innovation and its key features for business.
CO 2	Describe innovation management and difference between invention and innovation.
CO 3	Explain innovation as a management process, its management and perspectives. Understand Innovation management techniques.
CO 4	Explain innovation system, technology management and transfer.
CO 5	Explain technological entrepreneurship and institutional support.
TEXTBOOK:	
1	Carayannis, Elias G., Samara, Elpida T., Bakouros, Yannis L., “Innovation and Entrepreneurship Theory, Policy and Practice”, Springer, 2115.
REFERENCE BOOKS:	
1	Dick Whittington, “Digital Innovation and Entrepreneurship”, Cambridge University Press, 2118.

Course Articulation Matrix:

Course Code / Name : 21ME8X63/ INNOVATION AND ENTREPRENEURSHIP														
Course Outcomes (CO)	Program Outcomes (PO)												PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C-21ME8X63.1	3	2				1	1		1			1	3	1
C-21ME8X63.2	3	2				1	1		1			1	3	1
C-21ME8X63.3	2	2				1	1		1			1	3	1
C-21ME8X63.4	2	2				1	1		1			1	3	1
C-21ME8X63.5	3	2				1	1		1			1	3	1

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

INTRODUCTION TO YOGA				
Course Code:	21HU8X68	Course Type	OEC	
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Credits	03	
Total Teaching Hours	39	CIE + SEE Marks	50+50	

Course Learning Objectives:

1.	To give a brief history of the development of Yoga
2.	Identify names of different classical texts on Yoga
3.	To illustrate how Yoga is important for healthy living
4.	To explain the Asanas and other Yogic practices
5.	To explain, how Yoga practices can be applied for overall improvement

UNIT – I

09 Hours

07 Hours

UNIT – II

06 Hours

04 Hours

04 Hours

UNIT - III

05 Hours

04 Hours

1.	Understand a brief history of the development of Yoga
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- | | |
|----|--|
| 2. | Know important practices and principles of Yoga |
| 3. | Explain how Yoga is important for healthy living |
| 4. | Practice meditation to improvement of concentration etc. |
| 5. | Have knowledge about specific guidelines of yoga practices |

	Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
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↓ Course Outcomes													1	2
CO1						1			1			1		
CO2						1			1			3		
CO3						2			1			3		
CO4						3			2			3		
CO5						2			2			3		

1: Low 2: Medium 3: High

TEXTBOOKS:	
1.	B.K.S. Iyengar, “Light on Yoga: The Classic Guide to Yoga by the World’s Foremost Authority”, Thorsons publisher 2116.
2.	MakarandMadhukar Gore, “Anatomy and Physiology of Yogic Practices: Understanding of the Yogic Concepts and Physiological Mechanism of the Yogic Practices”, MotilalBanarsidass Publishers; 6 edition (2116).
3.	Swami SatyanandaSaraswati, “Asana, Pranayama, Mudra and Bandha: 1”, Yoga Publications Trust.
REFERENCE BOOKS:	
1.	Science of Yoga: Understand the Anatomy and Physiology to Perfect Your Practice by Ann Swanson
2.	Yoga for Everyone : 50 Poses For Every Type of Body by Dianne Bondy
E Books / MOOCs/ NPTEL	
1.	https://onlinecourses.swayam2.ac.in/aic19_ed29/preview
2.	https://youtu.be/FMf3bPS5wDs

OVERVIEW OF INDIAN CULTURE AND ART				
Course Code		21HU8X70	Course Type	OE
Teaching Hours/Week (L:T:P: S)		3:0:0:0	Credits	03
Total Teaching Hours		39+0+0	CIE + SEE Marks	50+50
Teaching Department: Humanities				
Course Learning Objectives:				
1.	To understand the relevance of Culture in Human Life, dynamism of Indian Culture and Arts through ages.			
2.	To understand the local culture and its vibrancies.			
3.	To develop awareness about Indian Society, Culture and Arts under Western rule.			
4.	To comprehend different dimension and aspects of the Indian culture and arts.			
5.	To appreciate cultural performances in India.			
UNIT - I				
Knowing Culture What is Culture, Different aspects of Culture, Cultural expression, Importance of Culture				7
Influence of Culture Relationship of Culture with: Language, Religion and History, Gender				7
UNIT - II				
Media and Culture Role of News Papers, Indian Cinema, Music, Advertisements				7
Languages, Literature and Culture Role of Sanskrit, Vedas, Upanishads, Ramayana and Mahabharata, Puranas, other Sanskrit Literature, Buddhist and Jain Literature, Dravidian Languages and Literature, North Indian Languages and Literature, Subaltern Literature				7

UNIT - III															
Arts and Culture Indian Theatre and Performing Arts, Ritual performances, and Tuluva cultural and ritual performances.													7		
(Self-study Component) Contribution of Indian History to Culture Ancient India – Persian and Macedonian invasions and its impact on Indian Culture, Development of Culture and Arts during the Mauryan Empire (Ashoka), the Guptas, the South Indian Dynasties – the Cholas, Nalanda as a Centre of Learning. Medieval India – Life of People under Delhi Sultanate, Rise of Islam and Sufism, Political Scene of India, Bhakti Movement, Folk Arts, Rise of Modern Indian Languages. Modern India – British Ruling and its impact on Indian Culture, Social and Religious Reforms, Indian National Movement and Achievement of Independence.													4		
Course Outcomes: At the end of the course student will be able to															
1.	Examine how the culture has a very important role in human life and growth of human civilization and have a general awareness on historical perspective of growth of Indian Culture and Arts.														
2.	Appreciate their own local culture from an academic perspective.														
3.	Know about the impact of Western Rule in India and Indian Struggle for Freedom and also its impact on Indian Culture and Arts and able to appreciate and the role of language in connecting people, growth of culture and arts beyond the barriers of religion and ages.														
4.	Take interest in learning these forms of arts, and also appreciate and preserve them for the future generations feeling proud of Indian Culture, Arts and Architecture.														
5.	Appreciate art performances in India which will enable them to get exposed to an artistic sphere, which eventually help them to be creative and imaginative.														
Course Outcomes Mapping with Program Outcomes & PSO															
Program Outcomes→		1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes														1	2
CO1			1				3		3	3	1		3		
CO2					2		3		2	3	3		3		
CO3							3		1				1		
CO4							3		2	1	2		3		
CO5							3		3	3	3		2		
1: Low 2: Medium 3: High															

PRINCIPLES TO PHYSICAL EDUCATION			
Course Code	21HU8X71	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This Course will enable students to

1. Appreciate and understand the value of physical education and its relationship to a healthy active lifestyle.
2. Work to their optimal level of physical fitness.
3. Show knowledge and understanding in a variety of physical activities and evaluate their own and others' performances.

UNIT - I

History of Physical Education - Olympic games, Modern Olympic games, Olympic Ideals & Objectives, Olympic Symbols, Olympic Flag, Olympic Emblem, Olympic Motto, Olympic Flame, Asian games

International Olympic Committee (IOC), Indian Olympic Association (IOA)

Sports awards - Eligibility, Objectives & Criteria

Yoga - Meaning and Importance

World Health organization (WHO)

10 Hours

UNIT – II

Concept of Health - Meaning of Health, Health Definition, Factors Affecting Health, Qualities of Healthy Person. Health Hazards of College Students, Physical Fitness and Exercises.

Food and Nutrition - Food & Nutrition Defined, Nutrients and their Functions - i) Proteins ii) Carbohydrates iii) Fats iv) Vitamins

Balanced Diet & Malnutrition

Health Education - Meaning of Health Education, Health Education Defined, Scope of Health Education, Importance of Health Education.

Posture - Concept of Posture, Correct Postures, Common Postural Defects

First Aid - First Aid Defined, Need and importance of First Aid, The Requisites of First Aid, Scope of First Aid, Qualities of a First Aider, Fundamental Principles to be followed and the Duties to be performed by the First Aider, First Aid in Different Cases.

Physical Education - Concept of Physical Education, Physical Education Defined, Importance of Physical Education, Scope of Physical Education, Aims and Objectives of Physical Education.

Teaching Aid in Physical Education

Competition - Introduction, Types of competition, Knock out, League or Round Robin Tournament.

12 Hours

UNIT – III

Training in Sports – Meaning, Principles, Warming Up & Limbering Down

Importance of Anatomy and Physiology in Physical Education, Oxygen Debt and Second wind

Leadership and Supervision – Leadership, Qualities of a good leader in Physical Education, Types of Leadership in Physical Education - 1. Teacher Leadership 2. Student Leadership.

Measurement & specification of various playing fields – Cricket, Volley Ball, Basket Ball, Badminton, Ball Badminton, Foot Ball, Hand Ball & their basic playing skills.

16 Hours

Course Outcomes:

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

1. Demonstrate an understanding of the principles and concepts related to a variety of physical activities.
2. Apply health and fitness principles effectively through a variety of physical activities.
3. Support and encourage others (towards a positive working environment).
4. Show self-motivation, organization and responsible behavior.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→ ↓ Course Outcomes	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
													1	2
CO1						3			2	1		1		
CO2						3			2	1		1		
CO3						3			2	1		1		
CO4						3			2	1		1		
CO5						3			2	1		1		

1: Low 2: Medium 3: High

TEXT AND REFERENCE BOOKS:

1. A. K. Uppal, “Physical Education and Health”
2. M. L. Kamlesh, “Fundamental Elements of physical Education”,
3. Swami Ramdev, “Yog its philosophy and practice”, Divya Prakashan
4. V. K. Sharma, “Health and Physical Education”

INTRODUCTION TO JAPANESE LANGUAGE																
Course Code					21HU8X72			Course Type					OEC			
Teaching Hours/Week (L:T:P: S)					3:0:0:0			Credits					03			
Total Teaching Hours					39+0+0			CIE + SEE Marks					50+50			
Teaching Department:																
Course Objectives:																
1.		Have basic spoken communication skills														
2.		Write Simple Sentences														
3.		Listen and comprehend basic Japanese spoken Japanese														
4.		Read and understand basic Japanese characters including Kanji														
UNIT - I																
(Lessons 1-6)															13	
Grammar – Introduction, Alphabets, Accents, Noun, Pronoun, Present Tense, Past tense																
Vocabulary – Numbers, Days, week days, months, Seasons, Nature, Dialogs and Video Clips																
UNIT - II																
(Lessons 7-13)															13	
Communication skills – Time, Adjective, Seasons, Conversation, Q&A																
Hobby, 5-W/1-H, Entering School/Company, Body Parts, Colours, Features etc.																
UNIT - III																
(Lessons 14-21)															13	
Japanese Counting System, Birth/Death, Dialogs (Going to Party, Restaurant), My day, Success/Failure, Kanji																
Characters, and sentence making, Video Clips																
Course Outcomes: At the end of the course student will be able to																
1.		Understand Simple words, expressions and sentences, spoken slowly and distinctly														
2.		Speak slowly and distinctly to comprehend														
3.		Read and Understand common words and sentences														
4.		Ask Basic questions and speak in simple sentences														
5.		Write Hiragana/Katakana and Kanji (121) characters.														
Course Outcomes Mapping with Program Outcomes & PSO																
	Program Outcomes→		1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
	↓ Course Outcomes														1	2
	CO1							3			2	1		1		
	CO2							3			2	1		1		
	CO3							3			2	1		1		
	CO4							3			2	1		1		
	CO5							3			2	1		1		
1: Low 2: Medium 3: High																

INTRODUCTION TO GERMAN LANGUAGE			
Course Code	21HU8X74	Course Type	OEK
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Credits	03
Total Teaching Hours	39+0+0	CIE + SEE Marks	50+50
Teaching Department: Mechanical			
Course Objectives:			
1.	Distinguish - definite and indefinite articles, declension of singular and plural nouns by adding certain endings to them to differentiate between subjects, objects and indirect objects and construct sentences of simple day to day usage.		
2.	Differentiate between nomnative and akkusative cases with transitive and intransitive verbs, and negation with Kein/e/er		
3.	Differentiate use of dative object besides the subject for some specific verbs and Apply the grammar principles of use of personal pronoun as a substitute for noun as per the case, number and gender of the noun.		
4.	Differentiate preposition forms when used exclusively in akkusative or Dative forms or on combination of the two cases		
5.	Differentiate conjugation of verbs in present, present-perfect and past participle tenses, separable and inseparable verbs, application of conjugation of modal verbs and position of modal verb in a sentence.		
UNIT - I			
Introduction: Mein Name ist (saying who you are, greeting people and saying goodbye, asking people where they come from and where they live. Language point: I and you), Lesen der politischenKarte der Welt, Nationalitaeten und Spachen, Die Uhrzeit (The time) telling time and talking about daily routine, Tage der Woche, die Monate, die vierJahreszeiten, die Jahre Mir gehes gut: Asking people how they are, saying how you are, saying which cities and counries people come from, Language points: verb endings), Wieschreibt man das (how do you write that?) Counting from 1-100 and above, alphabet, spelling our names and words, talking about us and them. Language points: Yes-no questions Artikel (Articles): As in English, there are definite (der/die/das) and indefinite (ein/eine) articles: the □ der/die/das; a/an □ ein/eine Die vierFälle (The four cases): Nominativ, Akkusativ, Dativ, Genitiv(Not in level A-1) Deklination des bestimmtenArtikels der/die/das Deklination des unbestimmtenArtikelsein/eine (Deklination/Declension: the variation of the form of a noun, pronoun, or adjective, by which its grammatical case, number, and gender are identified) Deklination von Substantiven (Declension of nouns) (Singular and Plural) (German nouns are declined by attaching certain endings to them, according to case, number and gender. This helps to differentiate between subjects, objects and indirect objects). Nominativ und Akkusativ(nominative and accusative cases) The verb determines the case of the noun. Some verbs only go with the nominative, others only with the accusative (or the dative). Thus, German verbs are either transitive or intransitive. (Nominative and accusative cases) Intransitive Verben (intransitive verbs) Transitive Verben (transitive verbs) Negation „kein/e/er “(negation with „kein/e/er “) (Singular und Plural) The negation of the indefinite article (ein/eine/ein) is kein/keine/kein. For this, you just have to put a „k“ at the beginning of the declined form of ein/eine/ein. Peter siehteinHaus. □ Negation □ Peter siehtkeinHaus. (Peter sees a house. □ negation □ Peter does not see a house.) (With examples, writing and hearing exercises, and German to English Glossary as applicable)			13
UNIT - II			
Dativ (the dative) (You are already familiar with verbs which require a direct accusative object in addition to the subject, which is in the nominative case. But there also some verbs which require a dative object besides the subject. To identify the dative object you ask “(To) whom?”) Der Plural (the plural)			13

<p>There are many different forms of the plural in the German language. Principally, the gender and the ending of the noun determine the plural form. Then, you either attach a plural ending to the noun, change a vowel, or keep the noun as it is in the singular.</p> <p>Das Personalpronomen (the personal pronoun) The personal pronoun is a substitute for a noun. Its forms are determined by the case, number and gender of the noun which is to be replaced.</p> <p>Die Formen des Personal pronomenimNominativ (The nominative forms of the personal pronoun):</p> <p>Präpositionen (prepositions) German prepositions are followed by an object, either in the accusative or the dative case. Some prepositions always take an accusative object, others always a dative object. But there are also prepositions which can be followed by both. In this case, the question “Where(to)?” (□ accusative) or “Where?” (□ dative) determines the case of the object.</p> <p>PräpositionenmitAkkusativ und Dativ (Prepositions with accusative and dative)</p> <ol style="list-style-type: none"> 1. PräpositionenmitAkkusativ (prepositions with accusative) 2. PräpositionenmitDativ (prepositions with dative) 3. PräpositionenmitAkkusativoderDativ (prepositions with accusative or dative) <p>(With examples, writing and hearing exercises, and German to English Glossary as applicable)</p>	
UNIT - III	
<p>Konjugation von VerbenimPräsens (Conjugation of verbs in present tense) Verbs are conjugated by attaching certain endings, depending on the person and number of the subject.</p> <p>Trennbare und untrennbareVerben (separable and inseparable verbs) Verbs with prefixes are distinguished between separable and inseparable verbs. The prefix of an inseparable verb must never be separated from the stem. Here the stress is on the stem: be- kommen. The prefix of a separable verb gets separated from the stem when the verb is conjugated. In the infinitive, the stress is on the prefix: an-kommen</p> <ol style="list-style-type: none"> 1. TrennbareVerben (separable verbs) 2. UntrennbareVerben (inseparable verbs) <p>Konjugation von VerbenimPerfekt (Conjugation of verbs in present perfect) The present perfect (Perfekt) describes something which happened in the past and is especially used in spoken German. It is formed with the present tense form of „haben“ or „sein“ and the past participle of the main verb.</p> <ol style="list-style-type: none"> 1. Die Bildung des Partizips (the formation of the past participle) 2. Die Bildung des Perfektsmit „haben“ und „sein“ (the formation of the present perfect with „haben“ and „sein“) <p>Modalverben (modal verbs) A modal verb is rarely used as a main verb; instead, it usually modifies the main verb. While the main verb remains in the infinitive, the modal verb is conjugated. In German, there are 7 modal verbs: können (can/be able), dürfen (may/be allowed), wollen (want), müssen (must/have to), sollen (shall), mögen (to like), möchten (wish/would like)</p> <ol style="list-style-type: none"> 1. Konjugation der Modalverben (Conjugation of the modal verbs) 2. Stellung des ModalverbsimSatz (Position of the modal verb within a sentence) <p>(With examples, writing and hearing exercises, and German to English Glossary as applicable)</p>	13

Course Outcomes: At the end of the course student will be able to																
1.	Distinguish - definite and indefinite articles, declension of singular and plural nouns by adding certain endings to them to differentiate between subjects, objects and indirect objects and construct sentences of simple day to day usage.															
2.	Differentiate between nomnative and akkusative cases with transitive and intransitive verbs, and negation with Kein/e/er															
3.	Differentiate use of dative object besides the subject for some specific verbs and Apply the grammar principles of use of personal pronoun as a substitute for noun as per the case, number and gender of the noun.															
4.	Differentiate preposition forms when used exclusively in akkusative or Dative forms or on combination of the two cases															
5.	Differentiate conjugation of verbs in present, present-perfect and past participle tenses, separable and inseparable verbs, application of conjugation of modal verbs and position of modal verb in a sentence.															
Course Outcomes Mapping with Program Outcomes & PSO																
	Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓		
	↓ Course Outcomes													1	2	
	HU1502-1.1						3			2	1		1			
	HU1502-1.2						3			2	1		1			
	HU1502-1.3						3			2	1		1			
	HU1502-1.4						3			2	1		1			
	HU1502-1.5						3			2	1		1			
1: Low 2: Medium 3: High																
TEXTBOOKS:																
1.	Ulrich Haessermann, Georg Dietrich, Christianne C. Guenther, Diethelm Kaminski, Ulrike Woods and Hugo Zenker, Sprachkurs Deutsch Neusaffung 1, UnterrichtswerkfuerErwachsene, Verlag Moritz Diesterweg, Universitaetsdruckerei H. Stuertz AG Wuerzburg, 1989															
2.	Paul Coggle and HeinerSchenke, Teach Yourself German (a complete course in understanding, speaking and writing), Teach Yourself Books, Hodden& Stoughton Educational, UK, 2101															
3.	Langenscheidt German In 30 Days: Book + Cd Paperback, www.amazon.in, – 1 September 2111															
REFERENCE MATERIALS:																
1.	Deutsche SprachlehrefürAusländer.															
2.	ThemenAktuell (Text and workbook).															
3.	Deutsch alsFremdsprache 1A.															
4.	Tangram Aktuell 1A/1B (Text and workbook).															
5.	Wherever required the Videos/Audios are also played in the class room sessions															
E-RESOURCES:																
1.	https://onlinecourses.nptel.ac.in/noc21_hs30/preview NPTEL-Swayam, German-I by Prof. MilindBrahme IIT Madras															
2.	https://www.trainerman.com/en/ powered by Sprachinstitut TREFFPUNKT Online															

SUSTAINABLE DEVELOPMENT GOALS			
Course code	21ME8X75	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03
Course Learning Objectives: Sustainable Development Goals is a 2116 United Nations officially released Agendas for Sustainable approach environmental integrity, economic viability and a just society for present and future generations. It aims to provide the knowledge, skills, attitudes and values necessary to address sustainable development challenges. They address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace and justice. Learn more and take action. This SDG program is organized in such a way to be research-led, applied interdisciplinary program that considers sustainability in both developed and developing societies, and addresses critical global challenges put forth by UN.			
UNIT – I			
The origin, development and idea of the SDGs History and origins of the Sustainable Development Goals. What are the SDGs? What are their aims, methodology and perspectives? How are they related to the Millennium Development Goals? SDGs and Society: Ensuring resilience and primary needs in society In-depth discussion and analysis of goals related to poverty, hunger, health & well-being and education			
			13 Hours
UNIT – II			
SDGs and Society: Strengthening Institutions for Sustainability In-depth discussion and analysis of goals related to gender equality, affordable and clean energy, sustainable cities & communities, and peace, justice & strong institutions SDGs and the Economy: Shaping a Sustainable Economy In-depth discussion and analysis of goals related to work & economic growth, industry, innovation & infrastructure, inequalities, responsible production & consumption			
			13 Hours
UNIT – III			
SDGs and the Biosphere: Development within Planetary Boundaries In-depth discussion and analysis of goals related to clean water, climate, life below water and life on land Realizing the SDGs: Implementation through Global Partnerships In-depth discussion and analysis of SDG 17 which aims to implement the SDGs through partnerships, finance, technology and the development of coherence between policies.			
			13 Hours

Course Outcomes:

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

CO 1	Summarize the UN's Sustainable Development Goals and how their aims, methodology and perspectives.
CO 2	Analyze the major issues affecting sustainable development and how sustainable development can be achieved in practice.
CO 3	Identify and apply methods for assessing the achievement/possibilities of sustainable development in Nitte gram panchayath.
CO 4	Evaluate the implications of overuse of resources, population growth and economic growth and sustainability & Explore the challenges the society faces in making transition to renewable resource use
CO 5	Create skills that will enable students to understand attitudes on individuals, society and their role regarding causes and solutions in the field of sustainable development.

TEXTBOOKS:

1. Sachs, Jeffrey D. The age of sustainable development. Columbia University Press, 2115
2. Gagnon, B., Leduc, R., and Savard, L., Sustainable development in engineering: a review of principles and definition of a conceptual framework. Cahier de recherche / Working Paper 08-18, 2108.
3. Dalby, Simon, et al. Achieving the Sustainable Development Goals: Global Governance Challenges. Routledge, 2119.
4. Sustainability: A Comprehensive Foundation by Tom Thesis and JonathanTomkin, Editors.

REFERENCE BOOKS:

1. Elliott, Jennifer. An introduction to sustainable development. Routledge, 2112.
2. Day, G.S., and P.J.H. Schoemaker (2111), Innovating in uncertain markets: 10 lessons for green technologies, MIT Sloan Management Review, 52.4: 37-45.

MOOC Resources:

1. <https://www.un.org/sustainabledevelopment/poverty/>

Course Articulation Matrix

Course Code / Name : 21ME/ SUSTAINABLE DEVELOPMENT GOALS														
Course Outcomes (CO)	Program Outcomes (PO)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	1	3	3	1	1	1		2	1	1
2	2	2	1	1	1	3	3	2	1	1		1	1	1
3	3	2	2	1	1	3	3	2	3	1		1	1	2
4	3	2	3	1	1	3	3	2	1	1		1	3	2
5	1	2	2	1	1	3	3	2	2	2		1	1	1

1: Low 2: Medium 3: High

Scheme of SEE Question Paper

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

WEB TECHNOLOGIES			
Course Code	21IS8X76	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives (CLOs):

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

- Illustrate the Semantic Structure of HTML and CSS
- Compose forms and tables using HTML and CSS
- Design Client-Side programs using JavaScript and Server-Side programs using PHP
- Illustrate the Database connectivity using PHP
- Examine JavaScript frameworks such as jQuery

UNIT - I

Introduction to HTML- Html tags and simple HTML forms, web site structure, HTML table, Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colours and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.

15 Hours

UNIT - II

Client side Scripting: Introduction to JavaScript: JavaScript language – declaring variables, scope of variables functions, event handlers (on click, on submit etc.), Document Object Model, Form validations. Introduction to PHP: Declaring variables, data types, arrays, strings, operations, expressions, control structures, functions, Reading data from web form controls like Text Boxes, radio buttons, lists etc.,

15 Hours

UNIT – III

PHP Databases: Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, File Handling in PHP, PHP Arrays and Superglobals, Arrays, \$_GET and \$_POST Superglobal Arrays, jQuery Introduction: What is jQuery, Adding jQuery in to your web pages, jQuery Syntax, jQuery Selectors, jQuery Events.

9 Hours

Course Outcomes:

Sl. No.	Course Outcome (CO)	Bloom's Taxonomy Level (BTL)
C8X52.1	Adapt HTML and CSS syntax and semantics to build web pages	L2
C8X52.2	Construct and visually format tables and forms using HTML and CSS	L3
C8X52.3	Experiment with the usage of Event handling and Form validation using Java script	L3
C8X52.4	Understand the principles of object oriented development using PHP and Database concepts	L2
C8X52.5	Inspect JavaScript frameworks like jQuery which facilitates developer to focus on core features.	L2

Table: Mapping of COs to PIs, POs and BTL

Course Outcomes (COs)	Program Outcomes (POs) Addressed	Performance Indicators (PI)	Bloom's Taxonomy Level (BTL)
CO1	1,3	1.3.1,1.4.1,3.2.1,	L2
CO2	1,2,3	1.4.1,3.2.1,3.2.2,2.1.1,2.2.4,3.1.6	L3
CO3	1,3	1.4.1,3.2.1,3.2.2,3.4.3	L3
CO4	1,2,3	1.4.1,3.2.1,3.2.2,2.1.1,2.2.4,3.1.6	L2
CO5	1,3	1.4.1,3.2.1,3.2.2	L2

Mapping Course Outcomes with Programme Outcomes:

POs COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
C8X52.1	1	2		2								1	2	
C8X52.2	1			2								1	2	
C8X52.3	1	2		2	3							1	2	
C8X52.4	1	2		2	3							1	2	
C8X52.5	1			2	3							1	2	

(L/1=Low30%-49%,M/2=Medium50%-69%,H/3=High>70%)

TEXTBOOK:

- Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson Education India. (ISBN:978-9332575271)

E RESOURCES:

- nptel.ac.in/courses/106105084/11

SEE Question Paper Pattern:

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabus & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit – III**.

PROGRAMMING IN JAVA			
Course Code	21CS8X77	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This course will enable students to:

1. Learn fundamental features of object oriented language and JAVA programming constructs.
2. Develop and run simple Java programs using OOPS concepts of java
3. Create multi-threaded programs and event driven Graphical User Interface (GUI) programming using swing package.

UNIT – I

Introduction to Java: Java's magic: The Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs. Data types, variables and arrays, Operators, Control Statements.

Classes, Inheritance: Classes fundamentals; Declaring objects; Call by value and Call by Reference, array of objects, Constructors, this keyword, and usage of static keyword.

Inheritance: inheritance basics, using super, creating multi-level hierarchy, method Overriding, abstract classes, final classes.

15 Hours

UNIT – II

Exception handling, packages and interfaces: Exception handling in Java, use of try, catch blocks, multiple catch blocks, finally block, use of throw and throws clauses, creating custom exceptions. Packages, Access Protection, Importing Packages, Interfaces. IO Streams for file handling.

Multi-Threaded Programming:

What are threads? How to make the classes threadable; Extending threads; Implementing runnable interface; creating multiple threads, join and is Alive methods of Thread class, Thread Synchronization; achieving thread synchronization among multiple threads. Thread priorities, methods to get and set thread priority

15 Hours

UNIT – III

Event Handling: Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces; Using the delegation event model;

Swings:

The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application; Create a Swing Applet; JLabel and ImageIcon; JTextField; The Swing Buttons; JTabbedPane; JScrollPane; JList; JComboBox; JTable.

09 Hours

Course Outcomes:

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

1. Apply the object-oriented concepts to solve real world problems using JAVA programming features
2. Illustrate the basic constructs and object oriented features of the Java language
3. Design a multi-threaded program using Java with exception handling
4. Develop Java programs that includes packages and interfaces and perform file operations in Java
5. Develop simple GUI interfaces for a computer program to interact with users, and to understand the event-based GUI handling principles using swings

Table-2: Mapping Levels of COs to POs / PSOs															
COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3			2				1	1		1	2	3	
CO2	1	2	2		1				1	1		1		3	
CO3	1	2	3		1				1	1		1		3	2
CO4	1	2	3		1				1	1		1	2	3	3
CO5	1	2	3		1				1	1		1		3	3

Graduate Attributes (GA)

This course will map the following GA as per NBA:

1. Design/Development of Solutions
2. Problem Analysis
3. Modern tool usage

TEXTBOOK:

1. Herbert Schildt, Java the Complete Reference, 7th Edition, Tata McGraw Hill, 2107. (Chapters 2-11, 22-24, 29,30)

REFERENCE BOOKS:

1. Mahesh Bhawe and Sunil Patekar, "Programming with Java", First Edition, Pearson Education, 2108, ISBN:9788131721806
2. Rajkumar Buyya, S Thamaras Selvi, Xingchen Chu, Object oriented Programming with Java, Tata McGraw Hill Education Private Limited.
3. Richard A Johnson, Introduction to Java Programming and OOAD, CENGAGE Learning.
4. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill Companies.

E-Books / Online Resources:

1. Online course material by Oracle :
<http://docs.oracle.com/javase/tutorial/index.html>
2. <https://www.udemy.com/courses/search/?q=java&price=price-free&view=grid>

MOOC:

1. Oracle: www.oracle.com/events/global/en/java.../java-a-beginners-guide-1721064.pdf
2. NPTEL: www.nptelvideos.com/java/java_video_lectures_tutorials.php

SEE SCHEME:

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit - II** and **1** full question from **Unit - III**.

DATA STRUCTURES AND ALGORITHMS			
Course Code	21CS8X78	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This course will enable students to:

1. **Outline** the concepts of data structures, its types, structures and pointers.
2. **Understand** linear data structures, namely, stack, queue, singly linked list and doubly linked list.
3. **Analyze** nonlinear data structures, namely, binary tree and graphs.
4. **Analyze** the non-recursive and recursive algorithms and to represent Efficiency of these algorithms in terms of the standard Asymptotic notations.
5. **Explain** the various algorithm design techniques and apply them to solve various real world problems.

UNIT – I

INTRODUCTION:

Data Structure, Classification (Primitive and non-primitive), data structure operations.

POINTERS:

Definition and Concepts, Accessing variables through pointers, Arrays and pointers. Structures, pointers to structures.

LINEAR DATA STRUCTURES – STACKS:

Introduction and Definition, Representation of stack: Array and structure representation of stacks, Operations on stacks using C functions (Push(), Pop(), IsStackFull(), IsStackEmpty()).

LINEAR DATA STRUCTURES – QUEUES:

Introduction and Definition Representation of Queue: Array and Structure representation of queue, Operations on Ordinary Queue using C functions (Insert(), Remove(), IsQueueFull(), IsQueueEmpty())

15 Hours

UNIT – II

LINEAR DATA STRUCTURES - SINGLY LINKED LISTS:

Dynamic Memory allocation functions. Definition and concepts singly linked List: Representation of link list in memory, Operations on singly Linked List using C functions (Insert node at front, Remove a node from front, display singly linked list).

LINEAR DATA STRUCTURES - DOUBLY LINKED LISTS:

Doubly Linked List: Representation. (Operations not included).

NONLINEAR DATA STRUCTURES – BINARY TREES:

Binary Trees: Properties, Linked representation of Binary Tree, Binary Tree Traversals, Introduction to Binary Search Tree.

INTRODUCTION TO ALGORITHMS:

What is an Algorithm? Fundamentals of Algorithmic Problem Solving, understanding and representing graphs using adjacency matrix and linked list.

FUNDAMENTALS OF THE ALGORITHMS EFFICIENCY:

Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms.

15 Hours

UNIT – III

DECREASE & CONQUER:

Concept of Decrease and Conquer, Graph traversal algorithms - Depth First Search, Breadth First Search.

DYNAMIC PROGRAMMING:

Concept of Dynamic Programming, Computing a Binomial Coefficient.

GREEDY METHOD:

Concept of Greedy technique, Prim's algorithm.

BACKTRACKING:

Concept of Backtracking technique, N-Queens problem.

9 Hours

Course Outcomes:

1. **Acquire** the fundamental knowledge of various types of data structures and pointers using that knowledge, analyze and design the programs using pointers
2. **Apply** the fundamental programming knowledge of data structures to analyze and design linear data structures, namely, stack, queue, singly linked list and doubly linked list and use them for solving problems.
3. **Implement** and apply the concept of binary trees and graph data structures and also understand their traversals.
4. **Analyze** non-recursive or recursive algorithm and to represent in terms of standard Asymptotic notations.
5. **Apply** Divide and Conquer, Decrease and Conquer, Dynamic programming, Greedy, and Backtracking algorithm design techniques to solve real time problems.

Table-2: Mapping Levels of COs to POs / PSOs															
COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2						1				1	3		
CO2	3	1	2					1				1	3		
CO3	3	2						1				1	3		
CO4	2	3												2	
CO5	2	2	3	2	3				1			1		3	
3: Substantial (High)				2: Moderate (Medium)						1: Poor (Low)					

TEXTBOOKS:

1. Aaron M. Tenenbaum, Yedidyah Langsam & Moshe J. Augenstein, “Data Structures using C”, Pearson Education/PHI, 2106.
2. Anany Levitin, “Introduction to the Design & Analysis of Algorithms”, 2nd Edition, Pearson Education, 2107.

REFERENCE BOOKS:

1. Ellis Horowitz and Sartaj Sahni, “Fundamentals of Data Structures in C”, 2nd edition, Universities Press, 2114.
2. Seymour Lipschutz, “Data Structures, Schaum’s Outlines”, Revised 1st edition, McGraw Hill, 2114.
3. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, “Introduction to Algorithms”, 2nd Edition, PHI, 2106.

MOOCs:

1. Introduction to Data Structures by edx , URL: <https://www.edx.org/course/>
2. Advance Data Structures by MIT OCW , URL: <https://www.mooclab.club/>
3. Data Structure by Harvard Extension School, URL: <http://www.extension.harvard.edu>
4. <http://nptel.ac.in/courses/106101060/>

SEE SCHEME:

There will be **8** questions of **21** marks each in the question paper divided into **3 Units** as per the syllabi & contact hours and the student will have to answer **5** full questions, selecting **2** full questions from **Unit - I & Unit – II** and **1** full question from **Unit –III**

ELECTRIC VEHICLE TECHNOLOGY			
Course Code	21EE8X79	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Eligible Students: For all engineering stream except E&E Engineering

Course Learning Objectives:

1. To Understand the fundamental laws and vehicle mechanics.
2. To Understand working of Electric Vehicles and recent trends.
3. Ability to analyze different power converter topology used for electric vehicle application.
4. Ability to develop the electric propulsion unit and its control for application of electric vehicles.

UNIT – I

Vehicle Mechanics: Roadway Fundamentals, Laws of Motion, Vehicle Kinetics, Dynamics of Vehicle Motion, Propulsion Power, Force-Velocity Characteristics, Maximum Gradability, Velocity and Acceleration, Constant FTR, Level Road, Velocity Profile, Distance Traversed, Tractive Power, Energy Required, Nonconstant FTR, General Acceleration, Propulsion System Design.

Electric and Hybrid Electric Vehicles: Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains. **14 Hours**

UNIT – II

Energy storage for EV and HEV: Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Super capacitors.

Electric Propulsion:

EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives. **16 Hours**

UNIT – III

Design of Electric and Hybrid Electric Vehicles: Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design.

9 Hours

Course Outcomes:

At the end of the course student will be able to

1. Explain the roadway fundamentals, laws of motion, vehicle mechanics and propulsion system design.
2. Explain the working of electric vehicles and hybrid electric vehicles in recent trends.
3. Model batteries, Fuel cells, PEMFC and super capacitors.
4. Analyze DC and AC drive topologies used for electric vehicle application.
5. Develop the electric propulsion unit and its control for application of electric vehicles.

Course Outcomes Mapping with Program Outcomes & PSO												
Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12
↓ Course Outcomes												
21EE8X .1	2	3										
21EE 8X .2	1	2	3									
21EE 8X .3	1	2	3									
21EE 8X .4	1	2	3									
21EE 8X .5	1	2	2									

1: Low 2: Medium 3: High

SEE QUESTION PAPER PATTERN:

- There will be **8** questions of **21** marks each in the question paper categorized into **3 Units** as per the syllabi & contact hours. The student will have to answer **5** full questions, selecting **2** full questions each from **Unit – I & Unit – II** and **1** full question from **Unit – III**.

TEXTBOOKS:

- Electric and Hybrid Vehicles: Design Fundamentals, Iqbal Husain, CRC Press, 2103
- Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design, M. Ehsani, Y. Gao, S.Gay and Ali Emadi, CRC Press, 2105

REFERENCE BOOKS:

- Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles, Sheldon S. Williamson, Springer, 2113.
- Modern Electric Vehicle Technology, C.C. Chan and K.T. Chau, OXFORD University, 2101
- Hybrid Electric Vehicles Principles And Applications With Practical Perspectives, Chris Mi, M. Abul Masrur, David Wenzhong Gao, Wiley Publication, 2101

E-Books / MOOC:

- Introduction to Mechanics | Coursera
- NPTEL: Electrical Engineering - Introduction to Hybrid and Electric Vehicles
- Electric Vehicles - Part 1 - Course (nptel.ac.in)
- Hybrid Vehicles (edX) | MOOC List (mooc-list.com)
- NPTEL: Electrical Engineering - Introduction to Hybrid and Electric Vehicles
- Electric Cars: Technology | My MOOC (my-mooc.com)

NATIONAL CADET CORPS: ORGANIZATION, FUNCTIONS AND CAPABILITIES			
Course Code	21HU8X81	Course Type	OEC
Teaching Hours/Week (L:T:P:S)	3:0:0:0	Credits	03
Total Teaching Hours	39+0+0	CIE + SEE Marks	50+50
Teaching Department: Chemistry			
Course Learning Objectives:			
1.	To create evolved youth, who will be equipped to contribute in the development of the nation.		
2.	To train students so as to achieve their physical and mental endurance. To acquire body language of a smart soldier and to inculcate the sense of authority by commanding the troop under him/her.		
3.	To inculcate spirit of adventure, undertake adventure activities, to hone leadership qualities and risk-taking abilities.		
4.	To understand and develop life skills, soft skills and to improve the emotional quotient of the student.		
5.	To impart basic military training, to develop awareness about the defense forces and expose learners to military ethos / values		
UNIT – I			
NCC: Aims, Objectives and Organization NCC General, Aims, Objectives and Organization of NCC. Duties of NCC Cadets, NCC Camps: Types and Conduct. National Integration: Importance and Necessity, Unity in Diversity.			7
Personality Development Self-Awareness, Empathy, Critical and Creative Thinking, Decision Making and Problem Solving. Communication Skills, Coping with stress and emotions. Leadership: Traits, Indicators, motivation, moral values, Honor Code. Social Service and Community Development.			7
UNIT – II			
Naval Communication and Seamanship Naval Communication: Introduction, Semaphore, Navigation: Navigation of Ships- Basic requirements, Chart work. Seamanship: Introduction to Anchor work, Rigging Capsule, Boat work- Parts of Boat, Boat pulling instructions, Whaler sailing instructions. Ship Modeling.			8
Disaster management and environmental awareness Disaster Management- Organization, Types of Disasters, Essential Services, Assistance, Civil Defence organization. Adventure Activities. Dos and Don’ts, Fire services and Firefighting, Environmental Awareness and Conservation.			8
UNIT – III			
Naval Orientation Naval Orientation- Armed Forces and Navy Capsule, EEZ Maritime Security & ICG. Border & Coastal Areas: Security setup and Boarder/Coastal management in the area. Naval Orientation: Modes of Entry- IN, ICG, Merchant Navy. Border and Coastal areas: Security Challenges & role of cadets in Border management			9

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

1.	Display sense of patriotism, secular values and shall be transformed into motivated youth who will contribute towards nation building through national unity and social cohesion.
2.	Demonstrate the sense of discipline, improve bearing, smartness, turnout and develop the quality of immediate and implicit obedience of orders, with good reflexes.
3.	Acquaint, expose & provide knowledge about Army/Navy/ Air force and acquire information about expanse of Armed Forces, service subjects and important battles.

Course Outcomes Mapping with Program Outcomes & PSO

Program Outcomes→	1	2	3	4	5	6	7	8	9	10	11	12	PSO↓	
↓ Course Outcomes													1	2
HU1505-1.1						3	3	1						
HU1505-1.2						3	3							
HU1505-1.3									1					

1: Low 2: Medium 3: High

REFERENCE BOOKS:

1.	Cadets Handbook, R.K. Gupta, Ramesh Publishing House, New Delhi.
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FUNDAMENTALS OF IMAGE PROCESSING – A PRACTICAL APPROACH			
Course Code	21EC8X82	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:0:1	SEE Marks	50
Total Hours	26:0:26	Credits	03

Course Learning Objectives:

This course will enable the students to

1. Understand basic operations on images.
2. Understand the concepts of colour models.
3. Explain image enhancement techniques.
4. Perform morphological operations on images.
5. Perform thresholding operation for image segmentation.

Software Tool Required: MATLAB

Image Fundamentals: Description of Image and Basic operations: Image Brightening, Darkening, Addition, Subtraction, Multiplication and logic operations, Binary and Gray scale images, Color Fundamentals.

Image Enhancement Techniques: Concept & Importance of Histogram, Basic gray level transformations, Histogram processing, Basics of spatial filtering, smoothing spatial filters, sharpening filters.

Morphological Operations and Thresholding: Introduction, Erosion and Dilation, Opening and Closing, Thresholding, segmentation methods.

26 Hours

List of Experiments:

1. Introduction to MATLAB.
2. Reading and analyzing images.
3. Image Conversions.
4. Basic operations on images.
5. Basic Arithmetic operations on images- Addition, Subtraction and Multiplication.

6. Exploring Image manipulation operations.
7. Histogram processing.
8. Demonstration of Effects of Filters on images-Smoothing.
9. Demonstration of Effects of Filters on images-Sharpening.
10. Exploring different color models.
11. Demonstration of Morphological Operations.
12. Demonstration of thresholding operations.
13. Exploring image segmentation methods.

Scheme of SEE

Laboratory based evaluation

Course Outcomes:

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

1. Demonstrate the understanding of basic operations on images
2. Apply image enhancement methods
3. Perform segmentation operation

Mapping of PO's/ PSO's & CO's:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	3	-	-	1	1	1	1	-	-	-	-
CO2	3	-	-	-	3	-	-	1	1	1	1	-	-	-	-
CO3	3	-	-	-	3	-	-	1	1	1	1	-	-	-	-
	3 – High				2 – Medium				1 - Low						

TEXTBOOKS:

1. R. C. Gonzalez and R. E Woods, “**Digital Image Processing**”, Pearson education (Asia)/Prentice Hall of India, 3rd Edition, 2109.
2. R. C. Gonzalez and R. E Woods, “**Digital Image Processing Using MATLAB**”, Pearson education (Asia)/Prentice Hall of India, 2nd Edition, 2111.
3. I.S. Jayaraman, S Esskairajan “**Digital Image Processing**”, illustrated, Tata McGraw-Hill Education, 2111.

NPTEL/ MOOC Link:

1. <https://nptel.ac.in/courses/117105135/>
2. <https://nptel.ac.in/courses/117105079>

INTRODUCTION TO YAKSHAGANA			
Course Code	21HU8X86	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning objectives:

The course will enable the students to:

1. Gain basic understanding of Thenku Thittu Yakshagana.
2. Perform basic movements.
3. Understand speech/dialogue, rhythm, Entry and improvisation skills.

UNIT – I

Introduction: Meaning and features, Origin and development, Difference between Thenkuthittu and Badaguthittu yakshagana. A brief introduction to Thenkuthittu Yakshagana. Thalasa-Aadi thala, yeka thala, Kore thala and Asta Thala with biditha and mukthya- Practice. Dhingina – Practice.....

14 Hours

UNIT – II

Thalas- Rupaka Thala, Trivide Thala, Jampe thala etc. with biditha and mukthaya. Dhigina – Practice Rangasthala Pravesha steps and Eripada ettugade steps. Revision of all Thalasa.

14 Hours

UNIT – III

Yakshagana Prasanga Practice- Abhinaya and presentation.....

11 Hours

Performance: The final part of the course is the performance. A Prasanga will be chosen and taught to the participants and they will perform the same in front of a live audience.

REFERENCE BOOKS:

1. Arthayana: Yakshagana Talamaddale Arthagarike: Ondu Vishleshane: Dr.Ramananda Banari.
2. Yaksha Naatyanjali Thenkuthittu- Sampadaka: Sathish Madivala, Karkala.
3. Yakshagna Shikshana Patya Pustka- Prathamika vibhaga (Karnataka Patya pusthaka sangha- Bengaluru)
4. Koralara: YakshaganaVimarsha Sankalana: Dr.M. Prabhakara Joshi
5. Vaagartha Gawrava: (Dr. Joshi Abhinandana Guchaha): Ga. Na. Bhat

MARKETING MANAGEMENT			
Course Code	21ME8X88	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Hours	39	Credits	03

Course Learning Objectives:

This Course will enable students to

1. Understand and learn the marketing concepts and their application to profit-oriented and non-profit oriented organizations.
2. Able to apply the marketing concepts to analyze the buying behavior & marketing segments to solve these problems.
3. Understand and learn the need for a customer orientation in product pricing & marketing research in the competitive global business environment;
4. Able to develop an understanding and acquiring skills in how to successfully design and implement marketing plans and strategies.
5. Understand and learn the concept of sales, advertising & distribution of marketing mix and its application in traditional and novel environments characterized by emerging information technologies.

UNIT - I

BASICS

Definition, Marketing Process, Dynamics, Needs, Wants & Demands, Marketing Concepts, Environment, mix, types, philosophies, Selling Vs. Marketing, organization, Industrial Vs. Consumer Marketing, Consumer goods, Industrial goods, Product hierarchy.

8 Hours

BUYING BEHAVIOUR & MARKET SEGMENTATION

Cultural, Demographic factors, Motives, types, Buying decisions, segmentation factors, Demographic, Psychographic & Geographic Segmentation, Process, Patterns.

8 Hours

UNIT - II

PRODUCT PRICING & MARKETING RESEARCH

Objectives, pricing, Decisions and Pricing methods, Pricing Management. Introduction, Uses, process of Marketing Research.

8 Hours

MARKETING PLANNING & STRATEGY FORMULATION

Components of a marketing plan, strategy formulations and the marketing process, implementation, Portfolio analysis, BCG, GEC grids.

8 Hours

UNIT - III

ADVERTISING, SALES PROMOTION & DISTRIBUTION

Characteristics, Impact, goals, types, Sales promotion-Point of Purchase, Unique Selling proposition.

Characteristics, Wholesaling, Retailing, channel design, logistics, Modern Trends in retailing.

7 Hours

Course Outcomes (CO):**At the end of the course the student will be able to**

CO1	Explain the basic marketing concepts
CO2	Interpret the buying behaviour of customers and role of marketing segments
CO3	Explain the role of product pricing and marketing research in the competitive global business environment
CO4	Analyse the marketing plans and strategies.
CO5	Explain the role of sales, advertising and distribution in marketing to achieve the goals of marketing

TEXTBOOK:

1. Govindarajan. M. 'Modern Marketing Management', Narosa Publishing House, New Delhi, 1999

REFERENCE BOOKS:

1. Philip Kotler, "Marketing Management: Analysis, Planning, Implementation and Control", 1998.
2. Green Paul.E. and Donald Tull, "Research for Marketing Decisions", 1975.
3. Ramaswamy.V.S. and S.Namakumari, "Marketing Environment: Planning, Implementation and Control the Indian Context", 1990
4. Jean Plerre Jannet Hubert D Hennessey Global Marketing Strategies.
