NATIONAL INSTITUTE OF TECHNOLOGY GOA
Farmagudi, Ponda, Goa – 403401

Phone No: 0832-2404200, Fax No: 2402202

AGENDA ITEMS FOR 16th MEETING OF THE SENATE

Date	:	**16th June 2021**
Time	:	**12:00 Noon**
Venue	:	Conference Hall, NIT Goa (Virtual Mode)

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Registrar
National Institute of Technology Goa
Farmagudi, Ponda-Goa 403 401

Director
National Institute of Technology Goa
Farmagudi, Ponda-Goa 403 401

The meeting started with formal introduction of the Registrar, Dr. Shashidhar K. Kudari to the members of Senate by the Chairman, Senate. The members of Senate applauded the contributionsof Dr. Vasantha M.H. as Registrar I/C and member of Senate and opined that the same may be put on record.

A. To confirm the minutes of 15th meeting of Senate held on 28/12/2020

Minutes of 15th meeting of the Senate of NIT Goa held on 28/12/2020 were circulated. Minutes may please be seen in the **ANNEXURE-I(Page No. 12-20).**

The Senate is requested to ratify the finalized minutes.

Resolution of the Senate:

The Senate ratified the minutes of the meeting held on 28/12/2020.

B. Action taken report on the resolutions taken in the last meeting of the Senate.

Resolution of the Senate:

The Senate noted the actions taken on the resolutions of the last meeting.

C.1 To deliberate and approve the proposed commencement of Ph.D. Programmes in Civil Engineering and Mechanical Engineering

The Departments of Civil and Mechanical Engineering were established in the year 2018. They offer undergraduate (B.Tech.) program in the fields of Civil Engineering and Mechanical Engineering respectively. The Institution and the faculty members are committed to provide the finest possible education to the students. For the betterment of institute and the departments, the PhD programme may be allowed.

The Senate is requested to approve this proposal.

Resolution of the Senate

The Senate appreciated and approved the proposal of commencement of Ph.D. Programmes in Civil Engineering and Mechanical Engineering.

C.2 To deliberate and approve the proposed syllabus for the course work for Ph.D. Programmes in Civil Engineering and Mechanical Engineering

The detailed syllabus for the course work for Ph.D. programmes in Civil and Mechanical Engineering is given in **ANNEXURE - V(Page No. 30-50)**.

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The Senate is requested to approve this proposal.

Resolution of the Senate:

The Senate approved the proposed syllabus for the course work of Ph.D. Programmes in Civil Engineering and Mechanical Engineering. The members also suggested that syllabus may be vetted by external experts. The members of Senate opined that Ph.D. students may be asked to deliver a talk as part of Research Methodology course, which will help them to improve their presentation skills.

C.3 To deliberate and approve the revision of remuneration for the foreign examiner

As per the institute norm, the remuneration for the foreign examiner to review the PhD thesis is fixed as USD 250 which includes tax. The remuneration may be revised as per the current scenario in the other NITs. The remuneration may be fixed as USD 400 (Including tax).

The Senate is requested to approve this proposal.

Resolution of the Senate:

The Senate recommended the proposal to revise the remuneration for the foreign examiner as USD 400 (including tax).

C.4To ratify the eligibility criteria for Ph.D. programme in Humanities and Social Sciences

The eligibility criteria for Ph.D. programme in Humanities and Social Sciences at NIT Goa require 60% marks in both B.A. and M.A. levels. But the students come from the universities under UGC because NITs and IITs do not offer B.A. (Hons) and M.A. programmes in Humanities (English specially). And as per UGC regulations, 55% marks is required for Ph.D. programme for General and OBC candidates and 50% marks for SC & ST candidates. IITs and some of the NITs follow the UGC rules and regulations for Ph.D. programme in Humanities and Social sciences, wherein it is mentioned 55% marks required at PG level for the admission to Ph.D. programme.

Hence the following eligibility criteria is proposed for Ph.D. programme in Humanities and Social Sciences department.

- Master's degree in Humanities with a minimum 6.0CGPA on a 10 point scale grading system or 55% marks in both Bachelor's and Master's levels from recognized Institute or University for General and OBC candidates. For SC/ST candidates a minimum 5.5 CGPA on a 10 point scale grading system or 50% marks.

The Senate is requested to ratify the same.

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Resolution of the Senate:

The Senate ratified this proposal on the eligibility criteria for PhD in Humanities and Social Sciences.

C.5To deliberate and approve the proposed PhD Full-Time admission for the forthcoming admission

As per the discussion in the Director, Registrar, Deans and HoDs meeting held on 3rd June, 2021, it is proposed that the faculty members who presently do not have any student under MHRD scholarship only may be allowed to take one PhD student in the forthcoming PhD admission 2021. The list of faculty members who do not have anyPhD student under MHRD scholarship presently is given below.

1. Dr. Sarani Ghosal Mondal (Humanities and Social Sciences) (HSS Department)
2. Dr. L. Shangerganesh(Applied Sciences Department)
3. Dr. Veena Thenkanidiyoor (CSE Department)
4. Dr. Keshavamurthy B.N. (CSE Department)
5. Dr. Damodar Reddy Edla (CSE Department)
6. Dr. B. Santhi (MCE Department)
7. Dr. Prasenjit Dey (MCE Department)
8. Dr. Harish N (CVE Department)
9. Dr. HarikumarMohanan (CVE Department)

The Senate is requested to deliberate this proposal.

Resolution of the Senate:

The Senate deliberated and recommended the proposal that the faculty members who presently do not have any PhD student under MHRD fellowship may each be allowed to take one full-time Ph.D. student (if found suitable) in the forthcoming Ph.D. Admission 2021. Other faculty members may look for suitable candidates for full time Ph.D. in the later sessions.

C.6Toratify the formation of Advisory Committees

NIT Goa has systematic processes followed for research, teaching learning, purchase and procurement. To fine tune the processes, the following advisory committees are constituted.

Academic Advisory Committee

- Dean(Academics) --- Chairperson
- Associate Dean (Academics) --- Convener
- Prof. H. K. Sharma. Director, NIT Agartala --- External Expert
- Prof. Rajeev Tripathi, Director, MNNITAllahabad --- External Expert

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- Prof. Vijay Desai, Department of Mechanical Engineering, NIT Karnataka, Surathkal --- External Expert
- Dr.VeenaThenkanidiyoor, Former Dean (Academics)--- Member

Research Advisory Committee

- Dean (Research and Consultancy) --- Chairperson
- Associate Dean (Research and Consultancy) ---Convener
- Prof.N C Shivaprakash,Department of Instrumentation, IISc, Bangalore --- External Expert
- Prof. Sunil Kumar Singh, Director, CSIR-NIO, Dona Paula, Goa --- External Expert
- Prof. U. ShripathiAcharya, Dean (Research and Consultancy), Department of Electronics and Communication Engineering, NIT Karnataka, Surathkal --- External Expert
- Dr. B. Venugopal Reddy, Former Dean (Research and Consultancy) --- Member

Purchase and Procurement Advisory Committee

- Dean (Planning and Development) --- Chairperson
- Associate Dean (Planning and Development) ---Convener
- Prof. Rajat Gupta, Director, NIT Mizoram --- External Expert
- Shri. SanjeevK. Sharma, Former Director (NITs), Department of Telecommunications --- External Expert
- Shri. Y. RamMohan, Joint Registrar Accounts, NIT Karnataka, Surathkal --- External Expert
- Dr. Purushothama B R, Former Dean (Planning and Development) --- Member

The Senate is requested to ratify the formation of committees.

Resolution of the Senate:

The Senate appreciated this idea and ratified the formation of these committees.

C.7 To deliberate and approve the inclusion of good B.Tech project into startup initiatives by the institute funding, proposal to be sent to BoG and FC for consideration

Some of the B.Tech students have done good project and are interested in startup initiatives. It is proposed that the institute may fund these kinds of startups initiatives and the proposal to be sent to BoG and FC for consideration.

The Senate is requested to approve this proposal.

Resolution of the Senate

The Senate recommended this proposal and suggested to initiate students to work on group projects with group members from different classes (2nd, 3rd and 4th year) and cross-

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disciplines. This will promote interdisciplinary projects. A research conclave may be organized every year where the students can present their work.

C.8 To deliberate and approve the consideration of the best B.Tech and M.Tech projects for the award and recognition in terms of cash prize and citation by the Director

It is observed that B.Tech. students have achieved good project outcomes during the major project work. Similar effort is being observed in M.Tech students too in their major project work. To further motivate the B.Tech. and M.Tech. students to carry out their major project work, it is proposed to consider the best B.Tech. and M.Tech. project work for the award and recognition in terms of cash prize and citation by the Director.

The Senate is requested to approve this proposal

Resolution of the Senate:

The Senate recommended this proposal and suggested that for fair evaluation, a jury of external experts has to be constituted. The internal and the external evaluation can each be for 50% weightage.

C.9 To deliberate and approve the proposal to be considered to make Graduate Aptitude Test in Engineering (GATE) compulsory for the final year students and weightage may be considered for the eighth semester grading

Technical institutes like NITs and IITs consider GATE as a qualitative and quantitative measure to assess the technical capabilities of students. Preparedness of a student to appear for GATE examination surely brings out the talent in him/her. Hence, it is proposed to make it compulsory for the final year students to appear for the GATE. The good performance in GATE may be awarded due weightage in the eighth semester grading.

The Senate is requested to approve this proposal

Resolution of the Senate

The Senate appreciated the idea of advising the students to appear for the GATE exam. However, the members opined that it may not be possible to implement the proposal of making GATE mandatory and giving weightage for eighth semester grading, in the present scenario. A fresh proposal is to be prepared for the next Senate meeting, exploring the possibility of awarding B.Tech. (Hons.) degree where weightage for GATE score can be considered.

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C.10 Presentation by Dean (Academics), Dean (R&C) and Dean (FW)

The activities of NIT Goa like academics, research and consultancy, and faculty during this pandemic period may be presented in this meeting.

The Senate appreciated the achievements of the students and faculty members of NIT Goa.

C.11 Additional items if any, with the approval of the Chairman

C.11.1 To deliberate and approve syllabi for Elective courses proposed for the B.Tech. Programmes in Civil Engineering and Mechanical Engineering

To better equip the B.Tech. students of Civil Engineering and Mechanical Engineering for the placement purpose, it is proposed to include the following two courses to the existing elective list of the respective programmes:

(i) Data Structures and Algorithms
(ii) Object Oriented Programming.

The detailed syllabi for the proposed elective courses for the B.Tech. programmes in Civil Engineering and Mechanical Engineering are given in **ANNEXURE - VI (Page No. 51-56)**.

The Senate is requested to approve this proposal.

Resolution of the Senate:

The Senate approved this proposal and suggested to include the electives in the 4th and 5th Semesters.

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ANNEXURE- I

NATIONAL INSTITUTE OF TECHNOLOGY GOA
Farmagudi, Ponda, Goa – 403401

Phone No: 0832-2404200, Fax No: 2402202

MINUTES OF 15th MEETING OF THE SENATE

Date	:	28th December 2020
Time	:	10:30 A.M
Venue	:	Conference Hall, NIT Goa (Virtual Mode)

Proceedings of the 15th meeting of the SENATEof NITGoa held on 28th December 2020 at 10:30 AM in Conference Hall, National Institute of Technology Goa. The meeting was held in virtual mode.

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Director
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Senate Members

1	Prof. Gopal Mugeraya	Director, NIT Goa	**Chairman Senate**
2	Prof. N.C. Shivaprakash	Department of Instrumentation Indian Institute of Sciences, Bengalooru	**External Member**
3	Prof. Vijay H. Desai	Department of Mechanical Engineering. NIT Karnataka,Surtahkal	**External Member**
4	Dr. Geetha B	Department of Humanities and Social Sciences,BITS Pilani, K.K. Birla Goa Campus	**External Member**
5	Dr. Vasantha M.H.	Registrar (I/C)	Member& Secretary
6	Dr. Veena Thenkanidiyoor	Dean(Academics)	Member
7	Dr. VelavanKathirvelu	Dean(Student Welfare)	Member
8	Dr. P. Saidi Reddy	Dean(Faculty Welfare)	Member
9	Dr. B. Venugopal Reddy	Dean(Research & Consultancy)	Member
10	Dr. Purushothama B. R.,	Dean(Planning and Development)	Member
11	Dr. Sarani Ghoshal M.	Dean(Institutional Relations & Alumni affairs)	Member
12	Dr. Nithin Kumar Y.B.	HoD,ECE	Member
13	Dr. Ragoju Ravi	HoD, HS	Member
14	Dr. Amol Rahulkar	HoD, EEE	Member
15	Dr. Keshavamurthy B.N.	HoD, CSE	Member
16	Dr. C.Vyjayanthi	HoD, CVE and MCE	Member

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Director
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ITEM NO. A: To confirm the minutes of the 14th (Special) meeting of Senate held on 15th May 2020 at NIT Goa in virtual mode

The minutes of the 14th (Special) meeting of the Senate held on 15th May 2020 were circulated among the members. The minutes may be confirmed by the Senate as placed in **ANNEXURE-I**

Senate members to confirm the minutes

ITEM NO. B: To receive information regarding Action Taken report (ATR) on decisions taken in 14th (Special) meeting of Senate

RESOLUTION	ACTION TAKEN
To take decision on the proposal on resumption of academic activity concerned to B.Tech. and M.Tech. students	The final year B.Tech. and M.Tech. and lower semester B.Tech. and M.Tech. students' examinations were conducted as per Senate decision

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C.1 To consider and approve the list of students of 2014-18 batch of B. Tech for the award of degree in the 6th Convocation

One student from 2014-2018 batch of B.Tech. is proposed for the award of B.Tech. degree in the 6h Convocation who has completed all the requirements towards the award of degree. The detail of the student is given in ANNEXURE II (Page No. 16-20)

Dept.	No. of students appeared for the final examination	No. of students eligible for the award of degree			
		CGPA 8.5 and above (Distinction)	CGPA 6.5 and above but less than 8.5 (First Class)	Less than 6.5 CGPA	Total No. of Students
CSE	0	0	0	0	0
EEE	1	0	0	1	1
ECE	0	0	0	0	0
TOTAL	**1**	**0**	**0**	**1**	**1**

Senate may recommend the proposed name for the award of the BTech degree.

Resolution of the Senate

Senate recommended the proposed name to the board for the award of the B.Tech. degree.

C.2 To consider and approve the list of students of 2015-19 batch of B. Tech for the award of degree in the 6thConvocation.

Three students from 2015-19 batch of B.Tech. areproposed for the award of B.Tech. degree in the 6thConvocation who have completed all the requirements towards the award of degree. The list of students proposed for the award of B.Tech. degree is given in ANNEXURE II (Page No. 16-20)

Dept.	No. of students appeared for the final examination	No. of students eligible for the award of degree			
		CGPA 8.5 and above (Distinction)	CGPA 6.5 and above but less than 8.5 (First Class)	Less than 6.5 CGPA	Total No. of Students
CSE	0	0	0	0	0
EEE	2	0	0	2	2
ECE	1	0	0	1	1
TOTAL	**3**	**0**	**0**	**3**	**3**

Senate may recommend the proposed names for the award of the BTech degree.

Resolution of the Senate

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Senate recommended the proposed names to the board for the award of the B.Tech. degree.

C.3 To consider and approve the list of students of 2016-20 batch of B. Tech for the award of degree in the 6th Convocation.

Total 65students from 2016-20 batch of B.Tech. areproposed for the award of B.Tech. degree in the 6th Convocation who have completed all the requirements towards the award of degree. The list of students proposed for the award of B.Tech. degree is given in ANNEXURE II (Page No. 16-20)

Dept.	No. of students appeared for the final examination	No. of students eligible for the award of degree			
		CGPA 8.5 and above (Distinction)	CGPA 6.5 and above but less than 8.5 (First Class)	Less than 6.5 CGPA	Total No. of Students
CSE	30	13	15	2	30
EEE	14	4	10	0	14
ECE	21	9	11	1	21
TOTAL	**65**	**26**	**36**	**3**	**65**

Senate may recommend the proposed names for the award of the BTech degree.

Resolution of the Senate

Senate recommended the proposed names to the board for the award of the B.Tech. degree.

C.4 To consider and approve the names of medal recipients of 2016-20 batch of B. Tech. who will be honored in 6th Convocation.

There will be one Gold medal called Director's Medal for academic topper of the Institute. There will be three Gold medals for the toppers in each department. The proposed names and details of the recipients are given in the following table.

Sl. No.	Medal Name	Dept.	Reg. No.	Student Name	CGPA
1	Director's Gold Medal	CSE	16CSE1018	RAGHAVENDRA NAGARAJ VERNEKAR	9.68
2	Gold Medal	CSE	16CSE1018	RAGHAVENDRA NAGARAJ VERNEKAR	9.68
3	Gold Medal	EEE	16EEE1003	BASWA VAMSI KRISHNA	9.14
4	Gold Medal	ECE	16ECE1025	UTKARSH UDAY UMARYE	9.50

Senate may recommend the proposed names for the presentation of the medals of the Institute.

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Resolution of the Senate

Senate recommended the proposed names to the board for the award of the medals of the Institute.

C.5 To consider and approve the list of candidates of 2018-20 batch of M. Tech. to be awarded with degree in the 6th Convocation.

Total 36students from 2018-20 batch of M.Tech. areproposed for the award of M.Tech. degree in the 6thConvocation who have completed all the requirements towards the award of degree. The list of students proposed for the award of M.Tech. degree is given in ANNEXURE III (Page No. 21-23)

S Specialization e n a t e	No. of students appeared for the final examination	No. of students eligible for the award of degree			
		CGPA 8.5 and above (Distinction)	CGPA 6.5 and above but less than 8.5 (First Class)	Less than 6.5 CGPA	Total No. of Students
CSE	11	3	7	1	**11**
PEPS	11	5	6	0	**11**
VLSI	14	6	8	0	**14**
TOTAL	**36**	**14**	**21**	**1**	**36**

may recommend the proposed names for the award of the MTech degree.

Resolution of the Senate

Senate recommended the proposed names to the board for the award of the M.Tech. degree.

C.6 To consider and approve the names of medal recipients of 2018-20 batch of M. Tech. who will be honored in 6thConvocation.

There will be one Gold medal called Director's Medal for academic topper of the Institute. There will be three Gold medals for the toppers in each department. The proposed names and details of the recipients is given in the following table.

Sl. No.	Medal Name	Dept.	Reg. No.	Student Name	CGPA
1	Director's Gold Medal	ECE (VLSI)	18ECE2008	NAIK SANMITRA BHARAT	9.91
2	Gold Medal	CSE	18CSE2005	NAIK PRAJYOT PRAKASH	9.64
3	Gold Medal	EEE (PEPS)	18EEE2009	KOLANTLA DHARANI	9.06
4	Gold Medal	ECE (VLSI)	18ECE2008	NAIK SANMITRA BHARAT	9.91

Senate may recommend the proposed names for the presentation of the medals of the Institute.

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Resolution of the Senate
Senate recommended the proposed names to the board for the award of the medals of the Institute.

C.7 To consider and approve the list of candidates to be conferred with the Ph.D. degree of the Institute

Four students are proposed for the award of Ph.D. degree in the 6th Convocation who has completed all the requirements towards the award of degree. The details of the students are given in ANNEXURE IV(Page No. 24)

Department	No. of students eligible for the award of degree
CSE	2
ECE	2
Total	4

Senate may recommend the proposed names for the PhD degree of the Institute.

Resolution of the Senate
Senate recommended the proposed names to the board for the award of the PhD degree of the Institute.

C.8 Additional items, if any, with permission of the Chairman, Senate

S.1 To consider and recommend name of students for the award of PhD degree

Two students from the department of CSE whose details are given below are also proposed for the award of the PhD degree of the Institute in the 6th Convocation of the Institute who has completed all the requirements towards the award of the degree.

Sl No	Roll No	Name	Gender	Thesis Title
1	15CSE3007	Naik Shraddha Mukund	Female	Development of Efficient Algorithms for Single-Pass Neural Networks
2	15CSE3001	Gaurav Pareek	Male	Cryptographic Solutions for Secure Sharing of Outsourced Data

Senate may recommend the proposed names for the PhD degree of the Institute.

Resolution of the Senate
Senate recommended the proposed names to the board for the award of the PhD degree of the Institute.

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Senate members expressed their appreciation towards the faculty of NIT Goa whose dedicated efforts are the reason behind the students whose names are being recommended for the degrees and medals of the Institute.

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ANNEXURE - II

NATIONAL INSTITUTE OF TECHNOLOGY GOA
BATCH: 2014-2018(PASSING OUT IN 2020)
DEPARTMENT: ELECTRICAL AND ELECTRONICS ENGINEERING

BACHELOR OF TECHNOLOGY

S.No.	Reg. No.	Name	Gender	CGPA
1.	14EEE1072	KUMAR RISHIDEO	MALE	6.02

NATIONAL INSTITUTE OF TECHNOLOGY GOA
BATCH: 2015-2019(PASSING OUT IN 2020)
DEPARTMENT: ELECTRICAL AND ELECTRONICS ENGINEERING

BACHELOR OF TECHNOLOGY

S.No.	Reg. No.	Name	Gender	CGPA
1.	15EEE1005	DHEERAJ BHUPELLI	MALE	6.47
2.	15EEE1006	GAONKAR GANDEEP GANESH	MALE	6.41

NATIONAL INSTITUTE OF TECHNOLOGY GOA
BATCH: 2015-2019(PASSING OUT IN 2020)
DEPARTMENT: ELECTRONICSAND COMMUNICATION ENGINEERING

BACHELOR OF TECHNOLOGY

S.No.	Reg. No.	Name	Gender	CGPA
1.	15ECE1005	DASARI AKHIL BABU	MALE	6.26

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NATIONAL INSTITUTE OF TECHNOLOGY GOA

BATCH: 2016-2020

DEPARTMENT: COMPUTER SCIENCE AND ENGINEERING

BACHELOR OF TECHNOLOGY

S.No.	Reg. No.	Name	Gender	CGPA
1.	16CSE1018	RAGHAVENDRA NAGARAJ VERNEKAR	MALE	9.68
2.	16CSE1016	POLEPALLI PRATHYUSHA	FEMALE	9.24
3.	16CSE1004	ARVIND RAMADURAI	MALE	9.16
4.	16CSE1008	EVANDER DARIUS SEQUEIRA	MALE	9.12
5.	16CSE1026	SHASHIKANT TANAJI KADAM	MALE	9.08
6.	16CSE1012	MILIND MARUTI PATIL	MALE	9.05
7.	16CSE1028	SIDDHARTH MANIKRAO DESHMUKH	MALE	8.86
8.	16CSE1032	VINEET MADHAV NAIQUE DHAIMODKER	MALE	8.84
9.	16CSE1020	RAHUL GANAPATI DESAI	MALE	8.82
10.	16CSE1006	BHARGAV KESA	MALE	8.72
11.	16CSE1027	SHIRODKAR VASSANT TRIVIKRAM	MALE	8.72
12.	16CSE1017	PRATIK PANDURANG POROB	MALE	8.70
13.	16CSE1033	SHEETAL	FEMALE	8.70
14.	16CSE1034	ALOK S JAISWAL	MALE	8.45
15.	16CSE1003	AKASH SINGH	MALE	8.40
16.	16CSE1011	KARISHMA KANDALA	FEMALE	8.30
17.	16CSE1002	ADIPELLI KRISHNACHYTANYA	MALE	8.23

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18.	16CSE1025	SHASHANK SHARMA	MALE	8.22	
19.	16CSE1013	NIKITA	FEMALE	8.07	
20.	16CSE1021	RAVI KUMAR PRASAD	MALE	7.99	
21.	16CSE1030	SRUTHY SAUNDRA RAJAN	FEMALE	7.95	
22.	16CSE1005	BATHINI KARTHIK REDDY	MALE	7.79	
23.	16CSE1001	AAKASH KUMAR	MALE	7.68	
24.	16CSE1023	SAKEEL	MALE	7.46	
25.	16CSE1031	THORATI MOJESH	MALE	7.13	
26.	16CSE1019	RAHEEL QASIM SHAIKH	MALE	6.95	
27.	16CSE1015	PRASHANT RAMOTRA	MALE	6.79	
28.	16CSE1024	SANTANOO MADHU	MALE	6.76	
29.	16CSE1014	REBELO PENJO	MALE	6.48	
30.	16CSE1029	SOHOM PANDA	MALE	6.48	

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NATIONAL INSTITUTE OF TECHNOLOGY GOA

BATCH: 2016-2020

DEPARTMENT: ELECTRICAL AND ELECTRONICS ENGINEERING

BACHELOR OF TECHNOLOGY

S.No.	Reg. No.	Name	Gender	CGPA
1.	16EEE1003	BASWA VAMSI KRISHNA	MALE	9.14
2.	16EEE1015	SPARSH SANTOSH LOTLIKAR	MALE	9.05
3.	16EEE1010	PRINCE P MATHEW	MALE	8.82
4.	16EEE1004	HARSHADA MEGHASHYAM HALARNKAR	FEMALE	8.68
5.	16EEE1001	SALAM ATHOIBI DEVI	FEMALE	8.29
6.	16EEE1013	SANGIREDDY MANEESH REDDY	MALE	8.06
7.	16EEE1011	SACHIN SURESH PATIL	MALE	7.90
8.	16EEE1018	TIRUMALASETTY VENKATA SAI CHARAN	MALE	7.88
9.	16EEE1012	SAMARTH RAMCHANDRA SURLEKAR	FEMALE	7.84
10.	16EEE1019	UMESH SHAMALAL WARADE	FEMALE	7.36
11.	16EEE1009	PRAFFUL SHIVAJI THORAT	MALE	7.25
12.	16EEE1020	VISHAKHA SHAMBHU GHADI	FEMALE	7.11
13.	16EEE1021	VISHNU M.	MALE	7.11
14.	16EEE1008	PRACHI PRAFULLA LONARE	FEMALE	6.58

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NATIONAL INSTITUTE OF TECHNOLOGY GOA

BATCH: 2016-2020

DEPARTMENT: ELECTRONICS AND COMMUNICATION ENGINEERING

BACHELOR OF TECHNOLOGY

S.No.	Reg. No.	Name	Gender	CGPA
1.	16ECE1025	UTKARSH UDAY UMARYE	MALE	9.50
2.	16ECE1011	R.KOUSALYA	FEMALE	9.39
3.	16ECE1027	MANU BHAT	MALE	9.21
4.	16ECE1004	BANDELA NAVYASRI MAHALAKSHMI	FEMALE	9.18
5.	16ECE1026	VISHAL RATHOD	MALE	9.17
6.	16ECE1028	SUKKHADA RAJEEV JOSHII	FEMALE	8.69
7.	16ECE1016	KARANAM NIHARIKA	FEMALE	8.58
8.	16ECE1017	PALADI MANIDEEP	MALE	8.53
9.	16ECE1010	KEDAR VINAYAK MAHALE	MALE	8.52
10.	16ECE1005	CHIRUMAMINDLA SUPRAJA	FEMALE	8.32
11.	16ECE1013	MITRA PRASHANT CHODANKAR	MALE	8.22
12.	16ECE1006	CHITTIVOLU SAINATH REDDY	MALE	8.10
13.	16ECE1012	MAHIMA SUSHANT TENDULKER	FEMALE	8.07
14.	16ECE1008	HARSHVARDHAN PRAKASH PAITHANE	MALE	7.87
15.	16ECE1023	SUNKIREDDY KARTHIK REDDY	MALE	7.58
16.	16ECE1015	MONIKA YADAV	FEMALE	7.50
17.	16ECE1024	SWATHI SIVADAS M	FEMALE	7.42
18.	16ECE1007	HARSH JAIPRAKASH HEGDE	MALE	7.28
19.	16ECE1019	RAHUL RAJESH KUMAR	MALE	7.10
20.	16ECE1022	SHIVASHARAN PRABHULINGAM MADDELA	MALE	6.99
21.	16ECE1020	RITESH KUMAR	MALE	6.42

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ANNEXURE- III

NATIONAL INSTITUTE OF TECHNOLOGY GOA

BATCH: 2018-2020

DEPARTMENT: COMPUTER SCIENCE AND ENGINEERING

MASTER OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING

S.No.	Reg. No.	Name	Gender	CGPA
1.	18CSE2005	NAIK PRAJYOT PRAKASH	MALE	9.64
2.	18CSE2007	PRASAD SHILPEE VIRENDRA KANTIDEVI	FEMALE	9.23
3.	18CSE2002	KIRUBA SAHARI N	FEMALE	8.66
4.	18CSE2001	AJIN MARTIN	MALE	8.34
5.	18CSE2011	SIDDHARTH S	MALE	8.30
6.	18CSE2008	RAYABARAPU SHIVAMALLIKARJUN	MALE	8.03
7.	18CSE2006	PRALHAD MAGADUM	MALE	7.67
8.	18CSE2010	S.RAGHUPATHI	MALE	7.64
9.	18CSE2012	SURYAWANSHI VAIBHAV KUNDALIK	MALE	7.11
10.	18CSE2009	ROMIL KUMAR	MALE	6.55
11.	18CSE2003	KUNVAR KANHAIYA	MALE	6.41

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NATIONAL INSTITUTE OF TECHNOLOGY GOA

BATCH: 2018-2020

DEPARTMENT: ELECTRICAL AND ELECTRONICS ENGINEERING

MASTER OF TECHNOLOGY IN POWER ELECTRONICS AND POWER SYSTEMS

S.No.	Reg. No.	Name	Gender	CGPA
1.	18EEE2009	KOLANTLA DHARANI	FEMALE	9.06
2.	18EEE2011	NITIN SINGH	MALE	8.88
3.	18EEE2012	RAHAMADULLAH A	MALE	8.77
4.	18EEE2007	JAPJEET KAUR	FEMALE	8.75
5.	18EEE2006	GOLI VAMSI PRIYA	FEMALE	8.55
6.	18EEE2008	KALLA YAMUNA	FEMALE	8.36
7.	18EEE2005	DEVANAND KUMAR	MALE	8.13
8.	18EEE2002	ARUNIMA S	FEMALE	8.09
9.	18EEE2013	VUYYURU HARINATHA REDDY	MALE	7.89
10.	18EEE2004	BOLLIPO RATNAKAR BABU	MALE	7.56
11.	18EEE2003	BHADRE SHUBHAM PANDURANG	MALE	6.64

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BATCH: 2018-2020

DEPARTMENT: ELECTRONICS AND COMMUNICATION ENGINEERING

MASTER OF TECHNOLOGY IN VLSI

S.No.	Reg. No.	Name	Gender	CGPA
1.	18ECE2008	NAIK SANMITRA BHARAT	MALE	9.91
2.	18ECE2006	MADDA NISHANTH	MALE	9.08
3.	18ECE2014	SURAJ SINGH DOHAR	MALE	8.83
4.	18ECE2011	PETA GURUPRAKASHKUMAR	MALE	8.70
5.	18ECE2004	BAMNE BHAGYASHREE BHIMRAO	FEMALE	8.64
6.	18ECE2007	N YASHWANTH	MALE	8.64
7.	18ECE2005	ELEENDRAM HARISH	MALE	8.28
8.	18ECE2010	PASUPULA SURESH	MALE	8.16
9.	18ECE2016	YARRAGUNTA JAYA SATYANARAYANA	MALE	7.98
10.	18ECE2003	ARAVIND ANILKUMAR V	MALE	7.95
11.	18ECE2002	APURVA VERMA	FEMALE	7.80
12.	18ECE2015	TYDULA KALYAN KUMAR	MALE	7.73
13.	18ECE2009	NITISH KUMAR	MALE	7.69
14.	18ECE2013	SHIV CHANDRA KUMAR	MALE	7.66

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ANNEXURE-IV

NATIONAL INSTITUTE OF TECHNOLOGY GOA

(GETTING AWARDED WITH PHD IN 2020)

DEPARTMENT: COMPUTER SCIENCE AND ENGINEERING

DOCTOR OF PHILOSOPHY

S.No.	Reg. No.	Name	Gender	Title
1	16CSE3001	ANNUSHREE BABLANI	FEMALE	**"Modeling and Simulation of Brain Computer Interface for Concealed Information Test"**
2	15CSE3005	SAUNHITA SAPRE	FEMALE	**"Metaheuristic Approaches for Relay Node Placement in Wireless Sensor Networks"**
3	15ECE3003	SHREE PRASAD M	MALE	**"Development of Efficient Source Localization Algorithms for Wireless Sensor Networks"**
4	15ECE3001	DEEPAK KUMAR ROUT	MALE	**"On Design of a Visual Surveillance System for Complex Underwater Scenarios"**

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ANNEXURE - V

DEPARTMENT OF CIVIL ENGINEERING

LIST OF COURSES AND SYLLABI ON STRUCTURAL ENGINEERING

1. ADVANCED STRUCTURAL ANALYSIS

Module 1: Introduction of Matrix Method of Structural Analysis,Static and kinematics indeterminacy of structures; Fundamentals of Flexibility and Stiffness method; Basic examples of application of Flexibility and Stiffness Method.

Module 2: Direct Stiffness Matrix Method,Derivation of local stiffness matrices for prismatic and non-prismatic members, transformation matrices and global stiffness matrices, assembling, compatibility equation. Application of Matrix Displacement Method to plane truss, space truss, beams, grids, plane frames and space frames subjected to various loadings including effects of temperature change and support displacements, Applications of software in structural analysis.

Module 3: Introduction to Finite Element Method,Introduction to principles of Finite Element Method and its application using two/three nodded bar element, beam element, three/four nodded plane elements.

Module 4: Special Structure,Beam on elastic foundation.

Module 5: Introduction to nonlinear structural analysis,Material and geometric nonlinear problems, incremental and iterative procedures, Convergence criteria, P-Δ effect, buckling of frames.

Text Books/References:

1. Weaver, W. and Gere J., Matrix Analysis of Framed Structures, CBS Publishers & Distributors, Delhi. 1982
2. Kenneth M. Leet, Chia-Ming Uang, Fundamentals of Structural Analysis, McGraw-Hill Book Company. 2017
3. Weaver, Jr. and James M. Gere, Matrix Analysis of Framed Structures, Van Nostran Reinhold / CBS. 1980

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4. Harry H. West and Louis F. Geschwinder, Fundamentals of Structural Analysis, John Wiley and Sons. 2002
5. R.R. Craig, Matrix Analysis of Structures, Cole Publishing Company.
6. McGuire, H.G. and Ziemian, R.D., Matrix Structural Analysis, John Wiley. 2000
7. Wang, C.K., Intermediate Structural Analysis, McGraw-Hill. 1982
8. Ghali, A. and Neville, A.., Structural Analysis, E & FN Spon, Taylor Francis. 2009
9. Hibbler R.C., Structural Analysis, Pearson Education, Asia. 2017

2. ADVANCED CONCRETE TECHNOLOGY

Module 1: Concrete Science,Standards – specifications – Ingredients - cement and its types – Coarse Aggregate – Fine Aggregate.Chemical admixtures - Mineral admixtures - Polymer concrete -Mix design - Mix Design by IS:10262-2019 - Mix Design by ACI :312 - Other methods of mix design.

Module 2: Concrete Types;Normal Vibrated Concrete - High volume fly ash concrete - High strength concrete - Reactive powder concrete & Oil well concrete - Ready mix concrete, pervious concrete.Fiber Reinforced Concrete – FRP in concrete - Self compacting concrete – Bacterial Concrete - Self curing concrete - Geopolymer Concrete.

Module 3: Durability and fire hazards in concrete, Deterioration of concrete - Factors effecting the durability - Sulphate attack - Acid attack, Alkali Aggregate reaction – Carbonation – Abrasion, Freezing and Thawing - Corrosion of Rebar - Rapid Chloride penetration test

Module 4: Use of waste materials in concrete,Waste from industry - Recycled aggregates – SustainabilityGreen concrete - Eco-Friendly Concrete

Module 5: Non Destruct Test (NDT): Rebound Hammer Test - Ultrasonic pulse velocity test - Core Extraction for Compressive Strength Test - Windsor Probe System – pull out resistance test – pull off test.

Module 6: Under Water Concrete:Tremie Method - Concrete in Cold weather - Concrete in Hot weather - miscellaneous topics

Text Books/References:

1. Shetty M. S. and Jain, A. K. "*Concrete Technology: Theory and Practice*" 2018

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2. Popovics, S. "*Concrete Materials, Properties, Specification and Testing*", Standard Publishers, India 2002
3. John Newman and Choo, B S "*Advanced Concrete Technology 2: Concrete Properties*" 2003
4. Neville,A.M. "*Properties of Concrete*" ELBS Ed. 2012
5. Satish Chandra ,"*Waste Materials in Concrete Manufacture*", Indian Standard Publishers 2002
6. Bungey, "*Non-destructive Testing in Concrete*", Surrey University Press, London.

3. STRUCTURAL DYNAMICS

Module 1: Sources of Structural vibrations; Meaning and types of excitations; spring action, spring in series and parallel. D'Alembert's Principle.

Module 2: Free vibrations of undamped and viscously damped SDOF systems; logarithmic decrement and its applications; Coulomb damping, material damping and radiation damping.

Module 3: Response to harmonic excitations – Duhamel's integral. Vibration isolation-and vibration absorption, Force transmissibility and base motion; Equivalent viscous damping and structural damping.

Module 4:MDOF systems: Vibrations of undamped 2 DOF systems; Free vibrations of MDOF systems, methods of solving eigenvalue problems; Characteristic equation method and other methods.

Modal analyses of MDOF systems: mode superposition method.

Module 5: Vibrations of Continuous systems: Free vibrations of continuous systems-axial transverse vibrations of beams. Numerical schemes for obtaining frequencies and mode shapes.Concept of Response spectrum and its applications.

Module 6: Nonlinear Systems: material and geometric nonlinearity; Seismic Response of Nonlinear Systems: Earthquake analysis of multi-storey building frames – time step analysis.Dynamic origin of Earthquake code provisions.

Texts/References:

1. Chopra, Anil K. *Dynamics of structures*. Pearson Education India, 2007.
2. Clough, R. W., and J. Penzien*Dynamics of Structures.* McGraw-Hill, New York, 1994.

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3. Paz, M., *Structural dynamics: theory and computation*, CBS Publishers, Delhi. 2004
4. Timoshenko, S. P., & Young, D. H., Advanced dynamics. McGraw Hill
5. Meirovitch, L., Elements of vibration analysis, McGraw-Hill.
6. Biggs, J. M., &Testa, B., Introduction to structural dynamics.
7. Craig, R. R., &Kurdila, A. J., Fundamentals of structural dynamics, John Wiley & Sons.
8. Paultre, P., Dynamics of structures, John Wiley & Sons.
9. T. K. Datta, Seismic Analysis of Structures, John Wiley & Sons (Asia)

4. FINITE ELEMENT METHODS

Module1: Introduction to Finite Element Method (FEM);Finite element formulations based on: Variational methods, Galerkin method, Virtual displacement;Fundamentals of discretization and shape functions;

Module 2: Isoparametric formulation;Analysis of truss using FEM;Analysis of frame using FEM;

Module 3: Plane stress and plane strain problem;Axisymmetric problems;

Module 4: Three dimensional FEM formulation;Introduction to application of FEM for plates and shells;

Module 5: Error analysis, convergence and mesh refinement;

Module 6:FEM for structural dynamics;Eigen analysis;Computer implementation of FEM algorithms.

Text Books/References:

1. R.D. Cook, D.S. Malkus and M.E. Plesha, Concepts and Applications of Finite Element Analysis, John Wiley & Sons, 2002.
2. J.N. Reddy, An Introduction to the Finite Element Method, Tata McGraw Hill, 2003.
3. S.S. Rao, Finite Element Method in Engineering, Butterworth Heinemann, 1999.
4. O.C. Zienkiewicz, R.L. Taylor and J.Z. Zhu, Finite Element Method Its Basis and Fundamentals, Elsevier, 2005.
5. K.J. Bathe, Finite Element Procedures, Prentice Hall of India Pvt. Ltd., 2002.
6. T.J.R. Hughes, The Finite Element Method: Linear Static and Dynamic Finite Element Analysis, Dover Publications, 2000.

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7. T.R. Chandrupatla and A.D. Belegundu, Introduction to Finite Elements in Engineering, Prentice Hall, 2003.
8. P. Seshu, Textbook of Finite Element Analysis, PHI Learning Pvt. Ltd., 2003.

5. COMPOSITE MATERIALS AND STRUCTURES

Module 1: Introduction: Definitions, Constituent materials, Types of fibres and matrices, Fabrication processes/ Manufacturing methods, Advantages and Drawbacks of composites, Overview of the field of applications.

Module 2: Micromechanics: Geometrical aspects, Volume and weight fractions, Longitudinal strength and stiffness, Transverse modulus, In-plane shear modulus, Introduction to mechanical testing of composites.

Module 3: Macro-mechanical Analysis of Laminated Composites: Stress-Strain relationship of a lamina, Transformation of stress and strain, Engineering constants, Laminates, Types (Symmetric and Anti-symmetric laminates, Quasi-Isotropic laminate, etc.), Elastic Moduli, Strain-displacement relationship, Stress-strain relations, Laminate stiffness, Compliance matrix.

Module 4: Analysis of Laminated Plates: Introduction to various plate theories, Classical Laminate Plate Theory, First Order Shear Deformation Theory, Introduction to Higher Order Shear Deformation Theory, Static analysis and free vibration analysis.

Module 5: Introduction to advanced topics: Finite element analysis of composite structures, Hygrothermal effects, Introduction to failure theories, Modelling and analysis of composite structure using ANSYS

Text Books/References:

1. Mechanics of Fibrous Composites, C.T. Herakovich, John Wiley & Sons, Inc. New York, 1998.
2. Mechanics of Composite Materials and Structures, M. Mukhopadhyay, University Press, 2004.
3. Jones, Robert M. Mechanics of Composite Materials. CRC press, 1998.
4. Mechanical Testing of Advanced Fibre Composites, J.M. Hodgkinson, Woodhead Publishing Limited, Cambridge, 2000.
5. ASTM standards.

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LIST OF COURSES AND SYLLABI ON GEOTECHNICAL ENGINEERING

1. REINFORCED EARTH AND GEOTEXTILES

Module 1: Introduction on reinforced earth and Geotextiles, principle and mechanism of reinforced soil, the nomenclature on various types of geosynthetics, functions of geotextiles, application areas, raw materials of geosynthetics and manufacturing methods.

Module 2: Geotextile Testing and evaluation, design methods on selection of the geotextiles, hydraulic characteristics of geotextiles, geogrid testing and evaluation, allowable versus ultimate geotextile properties-strength and flow related problems, designing with geotextiles for various functions of separation, filtration, and drainage applications

Module 3: Designing with geotextiles for soil reinforcement and roadway reinforcement functions, Geotextiles for improved bearing capacity in soft soils, Modes of failures, In-situ slope stabilization, Embankments on soft soils, Design and construction of geosynthetics, Reinforced soil retaining structures, Walls and slopes, and Codal provisions.

Module 4: Geosynthetics in Environmental control, liners for ponds and canals, covers and liners for landfills, material aspects and stability considerations, landfills, occurrences and methods of mitigation, Erosion causes and techniques for control

References:

1. Colin JFP Jones, Earth reinforcement and soil structures, 3rd edition, Thomas Telford Ltd, London, 1996
2. G L Sivakumar Babu, An introduction to soil reinforcement and geosynthetics, second edition, universities press Pvt. Ltd., Hyderabad, 2009
3. J.N Mandal, "Reinforced Soil and Geotextiles", Oxford and IBH Publishers Co. Pvt. Ltd, New Delhi, 1988
4. R.W. Sarsby, Geosynthetics in Civil Engineering,Woodhead publishers and CRC press, 2007
5. Robert M. Koerner, Designing with Geosynthetics, 6th edition, Xlibris Pub., 2012
6. Rao, G. V., and Suryanarayana Raju, G. V. S., Engineering with Geosynthetics, Tata Mc Graw Hill Publishing Co. New Delhi, 1996
7. Shukla, S. K., Geosynthetics and their Applications, Thomas Telford, London, 2002
8. Sanjay Kumar Shukla, Jian-Hua Yin, Fundamentals of geosynthetic Engineering, Taylors & Francis group, 2006
9. Swami Saran, Reinforced Soil and its engineering applications, I.K. Int. Pvt. Ltd., NewDelhi, 2006
10. T.S Ingold , "Reinforced Earth",Thomas Telford Ltd, London, 1982

2. FUNDAMENTALS OF SOIL BEHAVIOUR

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Module 1: Origin, nature and distribution of soil, description of individual particle, clay mineralogy, clay-water electrolytes, soil fabric and structure

Module 2: Effective stress principle, steady state flow in soil, effect of flow on effective stress, determination of coefficient of permeability, consolidation ,one, two, three and radial direction, variation of effective stress during consolidation, consolidation tests and determination of consolidation parameters

Module 3: Stress path, tri-axial and direct shear tests, shear behaviour of granular soils, factors affecting shear behaviour, determination of shear strength parameters, shear behaviour of fine grained soils, pore pressure parameters, UU,CU,CD tests, total and effective shear strength parameters, total and effective stress paths, factors affecting shear strength-stress history, rate of loading, structure and temperature, anisotropy of strength, thixotropy ,creep, determination of in situ undrained strength.

Module 4: Critical state model Introduction models and soil mechanics, use of models in engineering, elasticity, soil elasticity, plasticity and yielding, yielding of metal tubes in combined tension and torsion, elastic-plastic model for soil, elastic volumetric strains

References:

1. Holtg,R.D and Kovacs W.D., "An Introduction to Geotechnical Engineering" , Prentice hall CO, N.J. , 1981
2. Ishihara, K - Soil Behaviour in Earthquake Geotechnique , Oxford University Press, 1996
3. Mitchell, J. K., "Text book in Fundamentals of Soil Behaviour", 2Ed, John Wiley &Sons, New York, 1993
4. Muir Wood - Soil Behaviour and critical State Soil Mechanics, Cambridge University Press, 1994.
5. Nagaraj T.S and Srinivasa, B.S. - Analysis and Prediction of Soil Behaviour, Taylor and Francis, 1994.
6. Schofield and Worth - Critical State Soil Mechanics, McGraw Hill, 1968.

3. GROUND IMPROVEMENT

Module 1: Vibration techniques, dynamic compaction, depth of treatment, environmental considerations, practical application of vibro-techniques and dynamic compaction

Module 2: Classification of stabilizing agents, stabilizing agents, stabilization process, drainage and compaction, deleterious effects of organic substances and sulphates on inorganic stabilization, lime stabilization , lime column method, bearing capacity and settlement of lime columns, slope stability, stability of trenches, laboratory and field investigations, lime-sand columns, stone columns

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Module 3: Grouting techniques, chemical grouting, principles of injection, grout systems, grouting operations, applications, design methods, jet grouting, the jet grouting process, geometry and properties of soil used, properties of treated ground, application of jet grouting

Module 4: Soil fracturing techniques for terminating settlements and restoring levels of buildings and structures, injection technology and its effects, typical examples, in situ soil mixing techniques, construction techniques, testing procedures

References:

1. Moscly, M.P. "A Text book on Ground Improvement", Blackie Academic and Professional, 1994.
2. Raj, P. Purushothama, "Ground Improvement Techniques", Laxmi Publications, New Delhi, 2005

4. DESIGN OF ENGINEERED LANDFILLS

Module 1: Environmental-geotechnical application , introduction ,basic considerations of ground improvement systems ,load environmental factor design criteria, load factor design criteria and approaches , environmental load factor design criteria, soil structure , structural soil interaction , soil foundation structure interactions, load factor of safety and allowable condition, bearing capacity of granular soil, friction forces and angle between two materials.

Module 2: Liners, different types, properties of liners, clay liners, geo-synthetic liners, composite liners, design aspects

Module 3: Reclaiming potentially combustible sites , Introduction to combustion process, combustion tests , use of combustion potential tests, Land fill gases , principal gases and their properties, Gas monitoring ,Data assessment and remedial solutions.

Module 4: Establishment of new landscapes, Introduction, plant requirements, soil cover, soil fertility, site preparation, establishing grass cover, Establishing trees and shrubs, Maintenance.

References:

1. Hsai –yang Fang., "Introduction to Environmental Geotechenology" CRC press Newyork, 1997
2. Cairmey .T. , "Contaminated land problems and solutions", Blackie Academic & Professional, NewYork, 1993.

5. ADVANCED DESIGN OF FOUNDATIONS

Module 1: Soil -Structure Interaction Introduction to Soil -Structure interaction problems - Contact pressure distribution – factors influencing Contact pressure distribution beneath rigid

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and flexible footings – concentrically and eccentrically loaded cases – contact pressure distribution beneath rafts - Modulus of sub grade reaction – Determination and factors influencing modulus of sub grade reaction

Module 2: Pile Foundations: Introduction – Estimation of pile capacity by static and dynamic formulae – Wave equation method of analysis of pile resistance – Load -Transfer method of estimating pile capacity – Settlement of single pile – Elastic methods. Laterally loaded piles – Modulus of sub grade reaction method – ultimate lateral resistance of piles. Pile Groups – spacing – Efficiency of pile groups–Settlement of pile groups Pile caps –Pile load tests – Negative skin friction.

Module 3: Introduction to Machine Foundations Introduction -nature of dynamic loads -stress conditions on soil elements under earthquake loading - dynamic loads imposed by simple crank mechanism -type of machine foundations, special considerations for design of machine foundations – Criteria for a satisfactory machine foundation - methods of analysis of machine foundations - elastic half space theory-degrees of freedom of a block foundation –definition of soil spring constants-geometric and internal damping - methods of determination of soil constants in laboratory and field based on IS code provisions.

Module 4: Design of Machine Foundations, Vertical, sliding, rocking and yawing vibrations of a block foundation -simultaneous rocking, sliding and vertical vibrations of a block foundation - foundation of reciprocating machines -design criteria - calculation of induced forces and moments -multi-cylinder engines - Foundations subjected to impact loads - design criteria - analysis of vertical vibrations computation of dynamic forces - design of hammer foundations (IS code method) - vibration isolation – active and passive isolation - transmissibility -methods of isolation in machine foundations.

References:

1. Lambe and Whitman, "Soil Mechanics", Wiley Eastern., 1976.
2. Das B.M., "Advanced Soil Mechanics", Mc. Graw-Hill, NY, 1985.
3. Winterkorn H.F. and Fang H.Y. Ed., "Foundation Engineering Hand Book", Van-Nostrand Reinhold, 1975.
4. Bowles J.E., "Foundation Analysis and Design" (4Ed.), Mc.Graw –Hill, NY, 1996
5. Poulose H.G. and Davis E.H., "Pile foundation Analysis and Design", John-Wiley & Sons, NY, 1980.
6. Leonards G. Ed., "Foundation Engineering", Mc.Graw-Hill,NY, 1962.
7. Shamsher Prakash, "Soil Dynamics", McGraw Hill, 1981.
8. Alexander Major, "Dynamics in Soil Engineering", Akademiai,1980.
9. Sreenivasalu&Varadarajan, "Handbook of Machine Foundations", Tata McGraw Hill, 1976.
10. IS 2974 -Part I and II, "Design Considerations for Machine Foundations".
11. IS 5249: "Method of Test for Determination of Dynamic Properties of Soils".

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Department of Mechanical Engineering

Specialization: Design and manufacturing

SubjectCode *****	IndustrialErgonomics	Credits:3(3-0-0) Totalhours 42
CourseObjectives	• Tounderstandthe methodsandproceduresinergonomics • Todesign theman machinesystems • Toeliminateunnecessarywork byunderstanding workergonomics • Tostudythemosteffectiveprocedures forperformingwork	

Module 1: Introduction to Ergonomics: Ergonomics for productivity, safety, health and comfort, history ofergonomics,multi-disciplinaryengineering. **(4Hours)**

Module 2: Human-machine system and display:Human-machine system -characteristics, informationtheory, coding, compatibility, memory, decision making, attention, text, graphics, symbols, selection ofdisplaymodality-visualandauditorydisplay,representationaldisplay,tactualandolfactorydisplay,designofcontrols.(**8Hours)**

Module3: Anthropometry:Needforanthropometry,sourcesofhumanvariability,datacollectionmethodology, measuring procedures and tools, statistical analysis of measured data -percentile calculation,principlesofappliedanthropometry,applicationsofanthropometry.

(8Hours)

Module 4: Work Ergonomics: Work station design for standing and seated workers, manual materialhandling,designofhandtools,muscles,structure,functionandcapacity,physicalworkcapacity,measurement of physiological work, stress and fatigue, work-related musculoskeletal disorders, ergonomicinterventionstopreventinjuries,human thermoregulation,measurement,protectionandthermalcomfort.**(10Hours)**

Module 5: Vision, Noise and Vibration: Vision and the eye, measurement of light, lighting design, visualfatigue, eyestrain, psychological aspects of indoor lighting, the ear, measurement of sound, ear protection,design of acoustic environment, industrial noise control, auditory environment outdoors, effects of noise ontaskperformanceandhealth,vibration,humanerror,safetyandequipmentdesign. **(8Hours)**

Module 6: Introduction to Virtual Ergonomics: Digital Human Modelling (DHM), virtual ergonomicsevaluationtechniques-RapidUpperLimbAssessment(RULA). **(4Hours)**

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Text/ReferenceBooks	1. Bridger R S, "Introduction to Human Factors and Ergonomics", CRC Press, TaylorandFrancis Group, 2017. 2. MartinHelander,"AGuidetoHumanFactorsandErgonomics",CRCPress,TaylorandFrancis Group, 2005. 3. MarkSSanders,"HumanFactorsinEngineeringandDesign",McGrawHillEducation,2013. 4. ChristopherNemeth,"HumanFactorsMethodsforDesign",CRCPress,TaylorandFrancisGroup, 2004. 5. ChakrabartiD,"IndianAnthropometricDimensionsforErgonomicDesignPractice",NationalInstitute ofDesign, Ahmedabad,1997. 6. DuffyVG,"HandBookofDigitalHumanModelling:ResearchforAppliedErgonomicsandHumanFactorEngineering",CRCPress,TaylorandFrancisGroup, 2009

SubjectCode *****	**Productdesignanddevelopment**	**Credits:3(3-0-0)** **Totalhours 42**
CourseObjectives	• Tounderstandthefundamentals ofproduct design, strategies andanalysis • Tounderstandhumanconsiderationsandmodern approachesinproductdesign • Toknowthebasic knowledgeonreverse engineering	

Module 1: Introduction: Definition of product design, Design by evolution and Design by innovation,Essentialfactors,Morphologyofdesign,Primarydesignphasesandflowcharting. **(8hours)**

Module 2: History of Product Development, Development Processes and Organizations, Product PlanningIdentifyingCustomerNeeds,ProductSpecification. **(8hours)**

Module 3: Concept Generation: The activity of concept generation, clarify the problem, search externally,searchinternally,exploresystematically,reflectontheresultsandtheprocess.ConceptSelection,Overviewofmethodology,conceptscreening,andconceptscoring. **(10Hours)**

Module 4: Concept Selection and Testing: Define the purpose of concept test, choose a survey population,choose a survey format, communicate the concept, measure customer response, interpret the result, reflectontheresultsandtheprocess. **(10Hours)**

Module 5: Product Architecture, Industrial Design, Prototyping - Virtual and Physical. Rapid PrototypingTechnologies,EconomicfactorsinfluencingDesign. **(8hours)**

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Text/Refere nceBooks	1. UlrichandEppinger,"ProductDesignandDevelopment",TataMcGrawHill,2005 2. KOttoandKWood,"ProductDesign",Pearson Education,Inc.,2001 3. ChitaleandGupta,"Product designandManufacturing",PHI, 2005 4. KGCooper,"RapidPrototyping Technology",MarcelDekker, Inc.2001 5. DTPhamand SSDimov, "Rapid Manufacturing",Springer-Verlag,2001 6. BoothroydG,PeterDewhurst,WinstonA.Knight,"ProductdesignforManufactureandAssembly", MarcelDekkerInc, NewYork, 2010 7. G. Pahl, W. Beitz, W, Feldhusen, J and Grote, K.-H "Engineering Design",Springer,2007

SubjectCode *****	**Design for Manufacturing andAssembly**	**Credits:3(3-0-0)** **Totalhours 42**
CourseObjectives	• Toprovideknowledge aboutDesignformanufacturingand assembly • TodevelopknowledgeonManufacturingProcess • Todevelop knowledgeon assemblyto easetheassembly • ToprovidepracticalknowledgeapplicationofDFMAtechniques	
Module 1: Introduction to Design for manufacturing and assembly: Introduction, History of DFMA, StepsforapplyingDFMAduringproductdesign,AdvantagesofapplyingDFMAduringproductdesign,ReasonsfornotimplementingDFMA **(10Hours)** **Module2:**IntroductiontoManufacturingProcess:Classificationofmanufacturingprocess,Basicmanufacturing processes, the assembly process, Characteristics and applications, Example of commonassembly,Economicsignificanceofassembly **(10Hours)** **Module 3:**DesignforAssembly(DFA):Introductionto assembly,General taxonomies of assemblyoperationandsystems, assemblingaproduct, Designconsideration inassembly,VariousDFAtechniques **(10Hours)** **Module 4:** Case study on Application of Boothroyd DFMA techniques to product design and comparisonofothertechniques **(12Hours)**		
Text/Refere nceBooks	1. OMolloy,STilleyEAWarman,"DesignforManufacturingandAssembly",Springer,2012 2. BoothroydG,PeterDewhurst,WinstonA.Knight,"ProductdesignforManufactureandAssembly",Marcel DekkerInc,New York, 2010 3. JamesGBralla,"Designformanufacturability",McGraw-Hill,2004	

SubjectCode *****	**Additive Manufacturing**	**Credits:3(3-0-0)** **Totalhours 42**

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CourseObjectives	• Tounderstand the fundamentals ofvarious Additive Manufacturingtechnologiesforapplication to variousindustrial needs. • Tobeableto convertpartfileintoSTLformat. • Tounderstandthemethodofmanufacturingofliquidbased,powderbase dandsolidbasedtechniques. • Tounderstandthemanufacturingprocedureofaprototypeusing FDMtechnique.

Module1: IntroductionandClassificationofadditivemanufacturing:FundamentalsofAdditiveManufacturing (AM), historical development of AM, classifications of AM systems, information workflowinAM,impactofAMonproductdevelopment,reverseengineering,digitizationtechniques,modelconstruction. **(9Hours)**

Module2: Dataprocessingforadditivemanufacturing:AdditiveManufacturingdataformats,STLFormat,STL file problems, consequences of building a valid and invalid tessellated model, STL file repair, othertranslators,newlyproposedformatsstandardforrepresentinglayeredmanufacturingobjects. **(9 Hours)**

Module3: Solidandliquidbasedadditivemanufacturingsystems:FusedDepositionModelling,LaminatedObject Manufacturing (LOM), Stereolithography (SLA), Solid Ground Curing (SGC), Shape DepositionManufacturing(SDM),JP-System,polyjetprinting,principle,detailsofprocesses,processvariables,types,products,materials, advantagesandapplications. **(10Hours)**

Module 4: Powder based and other additive manufacturing systems: Selective Laser Sintering (SLS),Selective Laser Melting (SLM), Electron Beam Melting (EBM), powder based beam deposition processes,printingprocesses,Three-DimensionalPrinting(3DP),dropletformationtechnology,printingprocessmodelling, principle, details of processes, process variables, types, products, materials, advantages andapplications. **(10Hours)**

Module5: ApplicationsandRapidTooling:ApplicationsofAMinvariousindustries,Introductionto rapidtooling. **(6Hours)**

Text/Reference Books	1. GibsonI,RosenDW,StuckerB,"AdditiveManufacturingMethodologies:RapidPrototypingto Direct Digital Manufacturing", Springer,2015. 2. FrankWLiou,"RapidPrototypingandEngineeringApplications:AToolBoxforPrototypeDevelopment",CRC Press, 2019. 3. ChuaCK,LeongKF,LimCS,"RapidPrototyping:PrinciplesandApplications",WorldScientificPublishers, 2010. 4. HiltonPD,JacobsPF,"RapidTooling:TechnologiesandIndustrialApplications",CRCpress, 2011. 5. PhamDT,DimovSS, "RapidManufacturing",Verlag,2011. 6. PaulF.Jacobs, "Rapid PrototypingandManufacturing",ASME Press,1996 7. IanGibson,DavinRosen,BrentStucker,"AdditiveManufacturingTechnolo

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	gies",Springer,2014.

SubjectCode *****	**DigitalManufacturing**	**Credits:3(3-0-0)** **Totalhours 42**
CourseObjectives	• Tointroducethebasicsofdigitalizationandapplicationsinmanufacturing • Toprovide adeeper knowledgeinCAD/CAM/CAE • Toknowdigitaladvancesscopesandtheirimplementation • Tocreatearoadmapbetween digitalmanufacturingand designprofession	

Module1: Virtualprototypinganddigitalmanufacturing:History,Needfordigitalmanufacturing,Virtualprototyping in product development, Virtual prototyping tools, Digital technologies, Impact on economy,Digital technology in manufacturing, Architecture of digital manufacturing system, Operation mode andapplicationsofdigitalmanufacturing. **(12Hours)**

Module 2:CAD/CAM/CAE: Role of CAD in design, Types and applications of design models, Need forreverse engineering, Reverse engineering process, Reverse engineering hardware and software, CNC -Toolpath generation and simulation, CMM–History, economy, functionsand operation method,Additivemanufacturing–Need,applicationsandtypes,FEM–Nodegenerationtechniques,Meshgenerationtechniques. **(12Hours)**

Module3: Digitalfactoryandvirtualmanufacturing:Scope,Methodsandtoolsusedinvirtualmanufacturing,Benefits,Virtualfactorysimulation. **(12Hours)**

Module4: IntroductiontoInternetofThings:HistoryofIoT,WorkingofIoT,ApplicationsandChallengesofIoT,AdvantagesandDisadvantagesofIoT. **(6Hours)**

Text/Reference Books	1. AdrianMcEwanandHakimCassimally,"DesigningtheInternetofThings",Wiley,2013. 2. FrankWLiou,"RapidPrototypingandEngineeringApplication–AToolboxforPrototypeDevelopments", CRC Press, 2011. 3. VineshRajaandKiranJFernandes,"ReverseEngineering-AnIndustrialPerspective",Springer-Verlag, 2008. 4. GerardJounghyunKim,"DesigningVirtualSystems:TheStructuredApproach",Springer,2005. 5. JamesW Cortada,"TheDigitalHand-HowComputersChangedtheWorkof AmericanManufacturing",Transportation,andRetailIndustries,Oxford UniversityPress,2003.

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Specialization: Thermal and Fluids Engineering

Subject Code *****	**Advanced Heat Transfer**	**Credits: 3 (3-0-0)** **Total hours 42**
Course Objectives	• To provide an advanced understanding of the basic modes of heat transfer • To solve complex, coupled heat transfer problems by computational approaches • To teach basics of research and engineering in heat transfer	
Module1: Heat conduction - basic law, governing equations in differential form, solution methods, steady state, unsteady state problems-fins, moving boundaries.**(8 Hours)** **Module2:** Convective heat transfer - conservation equations, boundary layer approximations. Forced convective laminar and turbulent flow solutions. Natural convection solutions, correlations.**(8 Hours)** **Module3:** Radiation heat transfer mechanism; properties; exchange between black and non-black surfaces. **(7 Hours)** **Module4:**Condensation - mechanism, controlling parameters. Nusselt Theory; solution to laminar film modifications, influence of other parameters, correlations for single horizontal tube, vertical bank of horizontal tubes, other configurations. Dropwise condensation.Boiling mechanisms regimes. Basic models, correlations.**(12 Hours)** **Module5:** Mass Transfer- governing laws, transfer coefficients; application. Heat exchangers. Design principles.**(7 Hours)**		
Text/Reference Books	1. Greg F. Naterer, "Advanced Heat Transfer", CRC Press, 2018 2. E.R.G. Eckerst and R.M. Drake Jr, Analysis of Heat Transfer, McGraw-Hill, 1972. 3. Amir Faghri, Yuwen Zhang, John R. Howell, "Advanced Heat and Mass Transfer", Global Digital Press, 2010 4. B. Gebhart, Heat Transfer, McGraw-Hill, 1971. 5. B. Sundén, C.A. Brebbia, and D. Poljak, "Advanced Computational Methods and Experiments in Heat Transfer XII", WIT Press, 2012	

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Subject Code *****	**Interfacial Transport Phenomena**	**Credits: 3 (3-0-0)** **Total hours 42**
Course Objectives	• To develop knowledge on transport phenomena or continuum mechanics focused on momentum, energy, and mass transfer at interfaces.	

Module 1: Basic Concepts of interfaces: Interfacial Tension, Laplace Equation, Contact Angle, and Young-Laplace Equation.**(6 Hours)**

Module 2: Surface energy: Surface tension driven flows, Coating flows, Thermocapillary flows, capillary phenomena.**(5 Hours)**

Module 3: Wetting: Wetting and spreading of liquids, wetting line pinning and hysteresis, dynamics of wetting, three phase contact line, Moving contact lines, wetting of textured surfaces, wetting and porous media. **(8 Hours)**

Module 4: Capillary Statics: Shapes of Drops and Thin films. Jets and Drops: Generation, Dynamics, Stability and impact with solid surfaces, Rayleigh instability. **(6 Hours)**

Module 5: Surfactants, Bubbles: Properties of surfactant solutions and surface films, nucleation, stability, dynamics of bubbles.**(6 Hours)**

Module 6: Experimental techniques involving interfaces: High-speed visualization, Laser-based ultrafast temperature measurements, optical microscopy.**(6 Hours)**

Module 7: Applications of interfaces in microfluidic systems-flow segmentation in microchannels, inkjet printing.**(5 Hours)**

Text/Reference Books	1. De Gennes P-G, Brochard-Wyart F, Quere D, "Capillarity and wetting Phenomena", Springer, 2003. 2. J. C. Slattery, "Interfacial Transport Phenomena", Springer-Verlag, New York, 1990. 3. C. A. Miller and P. Neogi, "Interfacial Phenomena", Dekker, CRC Press, 2007. 4. R. J. Stokes and D. F. Evans, "Fundamentals of Interfacial Engineering", Wiley-VCH, New York, 1997. 5. D. A. Edwards, H. Brenner and D. T. Wasan, "Interfacial Transport Processes and Rheology", Butterworth-Heinmann, New York, 1990.

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Subject Code *****	**Experimental Methods in Thermal and Fluids Engineering**	**Credits: 3 (3-0-0)** **Total hours 42**
Course Objectives	• To provide knowledge about experimental methods and measurement techniques in the fields of Fluid Mechanics and Heat Transfer • To develop knowledge on data analysis and measurement uncertainties to correctly represent experimental results, and to adequately plan the experiments.	

Module 1: Planning of experiments: preliminary, intermediate and final stages in experimental investigations. Steady state and transient techniques. Selection of measuring devices based on static, dynamic characteristics and allowable uncertainties. **(10 Hours)**

Module 2: Analysis of experimental data and determination of overall uncertainties in experimental investigation, curve fitting and report writing. Calibration of temperature measuring devices, uncertainties in measurement of temperature under various conditions.**(10 Hours)**

Module 3: Optical and radiation methods of temperature measurement. Steady state and transient methods of measuring heat fluxes. Measurement of thermal radiation and associated parameters.

(8 Hours)

Module 4: Calibration of pressure and vaccum measuring devices. Estimation of uncertainties in measurements of pressure and vaccum. Calibration of flow and velocity measuring devices.

(7 Hours)

Module 5: Uncertainties in measurement under various conditions. Measurement of turbulence, hot wire/film anemometers. Measurement of thermophysical properties. **(7 Hours)**

Text/Reference Books	1. E.O. Doebelin "Measurement systems, Application and Design", McGraw-Hill 1990 2. J.P. Holman "Experimental Methods for Engineers", McGraw-Hill, 1994 3. E.R.G. Eckert and Goldsteen "Measurement Techniques in Heat Transfer", Technovision, 1970 4. R.J. Goldstein (Editor), "Fluid Mechanics Measurements", Hemisphere Publishing Corporation, 1996. 5. H.W. Coleman and W.G. Steele, "Experiments and Uncertainty Analysis for Engineers", Wiley-Interscience, 2008.

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Subject Code *****	**Microfluidics**	**Credits: 3 (3-0-0)** **Total hours 42**
Course Objectives	• To understand the basic principles of micro-scale fluidic mechanics, key components in microfluidic devices and their fabrication techniques, and applicationsof microfluidics in various emerging fields.	

Module 1: Introduction: Fundamentals of kinetic theory-molecular models, micro and macroscopic properties, binary collisions, distribution functions, Boltzmann equation and Maxwellian distribution functions, continuum hypothesis and deviations from the same, scaling laws for micro-domains.

(7 Hours)

Module 2: Microscale gas flows: Wall slip effects and accommodation coefficients, flow and heat transfer analysis of microscale Couette flows, Pressure driven gas micro-flows with wall slip effects, heat transfer in micro-Poiseuille flows, effects of compressibility, introductory concepts on gas flows in transitional and free molecular regimes, some representative applications of micro-scale gas flows in accelerometers, micro-propulsion and micro-nozzles. **(10 Hours)**

Module 3: Microscale liquid flows: Pressure driven liquid microflow, apparent slip effects, physics of near-wall microscale liquid flows, capillary flows, electro-kinetically driven liquid micro-flows and electric double layer (EDL) effects, concepts of electroosmosis, electrophoresis and dielectro-phoresis, analysis of hydro-dynamically and thermally fully developed electro-osmotic flows, ac electro-osmosis. **(12 Hours)**

Module 4: An introduction to fluid dynamics over nano scales (nanofluidics), concepts of nano-fluids and their augmented transport characteristics, An introduction to bio-microfluidics and some illustrative applications (drug delivery, DNA hybridization, leuokocyte rolling etc.)**(7 Hours)**

Module 5: An introduction to special computational modelling of micro-flows: MD and DSMC methods.**(6 Hours)**

Text/Reference Books	1. B.J. Kirby, "Micro-and nanoscale fluid mechanics: transport in microfluidic devices" Cambridge university press, 2010 2. Keith E. Herold1 and Avraham Rasooly, "Lab-on-a-Chip Technology (Vol. 1): Fabrication and Microfluidics", Caister Academic Press, 2009 3. Nguyen, Nam-Trung, Steven T. Wereley, and Seyed Ali Mousavi Shaegh. "Fundamentals and applications of microfluidics", Artech house, 2019. 4. Bruus, Henrik. "Theoretical microfluidics", Oxford: Oxford university press, 2008.

Subject Code	**Renewable Energy and Energy**	**Credits: 3 (3-0-0)**

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*****	**Harvesting**	**Total hours 42**
Course Objectives	• To understand the basic principles of micro-scale fluidic mechanics, key components in microfluidic devices and their fabrication techniques, and applicationsof microfluidics in various emerging fields.	

Module 1: Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems. **(8 Hours)**

Module 2: Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. **(6 Hours)**

Module 3: Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices.**(6 Hours)**

Module 4: Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.**(4 Hours)**

Module 5: Geothermal and Hydro Energy: Geothermal Resources, Geothermal Technologies, Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.**(6 Hours)**

Module 6: Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications. **(8 Hours)**

Module 7: Electromagnetic Energy Harvesting: Linear generators, physics mathematical models, recent applications.**(4 Hours)**

Text/Reference Books	1. Tom J. Kaźmierski, Steve Beeby, "Energy Harvesting Systems", Springer-Verlag New York, 2011 2. Sukathme S.P., Solar Energy Principles of Thermal Collection and Storage, 2nd Ed., TMC New Delhi,1984 3. Niell Elvin, AlperErturk (auth.), Niell Elvin, AlperErturk, "Advances in Energy Harvesting Methods", Springer-Verlag New York, 2013 4. Bent Sorensen, Bent Srensen, "Renewable Energy", Academic Press, 1997

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