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(Established as a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)
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Course Structure and Detailed Syllabus

of

First Year Engineering

for

B. Tech Programme in

Electronics and Telecommunication Engineering

and

B. Tech Programme in

VLSI Design and Technology

In line with National Education Policy 2020

(Effective from Academic year 2023-24 for University campus only)

Department of Electronics and Telecommunication Engineering

Credit Framework under Four-Years UG Engineering Programme with Multiple Entry and Multiple Exit options:

- The Four-year Bachelor's Multidisciplinary Engineering Degree Programme allows the students to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per their choices and the feasibility of exploring learning from different institutions.
- The minimum and maximum credit structure for different levels under the Four-year Bachelor's Multidisciplinary Engineering UG Programme with multiple entry and multiple exit options are as given below:

Credit Framework

Levels	Qualification Title	Credit Requirements		Semester	Year
		Minimum	Maximum		
4.5	One Year UG Certificate in Engg./ Tech.	40	44	2	1
5.0	Two Years UG Diploma in Engg./ Tech.	80	88	4	2
5.5	Three Years Bachelor's Degree in Vocation (B. Voc.) or B. Sc. (Engg./ Tech.)	120	132	6	3
	4-Years Bachelor's degree				

Levels	Qualification Title	Credit Requirements		Semester	Year
		Minimum	Maximum		
6.0	(B.E./ B.Tech. or Equivalent) in Engg./ Tech. with Multidisciplinary Minor	160	176	8	4
6.0	4-Years Bachelor's degree (B.E./ B.Tech. or Equivalent) in Engg./ Tech.- Honors and Multidisciplinary Minor	180	194	8	4
6.0	4-Years Bachelor's degree (B.E./ B.Tech. or Equivalent) in Engg./ Tech.- Honors with Research and Multidisciplinary Minor	180	194	8	4
6.0	4-Years Bachelor's degree (B.E./ B.Tech. or Equivalent) in Engg./ Tech.- Major Engg. Discipline with Double Minors (Multidisciplinary and Specialization Minors)	180	194	8	4

- There are multiple exit options at each level. Student will be given a specific Qualification mentioned in the table depending on the level at which he/she decide to have an exit. Ex. If a student decides to exit after completion of two years (level 5.0) of the program, he will be given a Diploma in Engineering with specific exit condition mentioned in the syllabus of the specific branch. He/she can rejoin the program with the multiple entry option at the level next where he/she chose to exit previously. (Student can join at level 5.5 if successfully completed level 5.0 previously at the time of exit).

- Minimum credit requirements of each level are mentioned in the credit framework table.
- There are 4 distinct options available at level 6.0.
- First one is basic level 6.0 option where minimum 160-maximum 176 credits are mandatory which can be completed as per the Semester-wise Credit distribution structure mentioned in the table given below.
  Here, the Bachelor's Engineering Degree in chosen Engg./ Tech. Discipline with multidisciplinary minor (min.160-max.176 Credits) i.e. "**B. Tech in Electronics and Telecommunication Engineering with Computer Engineering**" (160-176 credits) enables students to take up five-six or required additional courses of 14 credits in the discipline other than Electronics and Telecommunication Engineering distributed over semesters III to VIII. Here in the case of "**B. Tech in Electronics and Telecommunication Engineering with Computer Engineering**" (160-176 credits) student is supposed to take up 50% or more courses to complete the 50% or more credits (from assigned 14 credits) from **Computer Engineering minor bucket**. The remaining courses to complete the assigned 14 credits can be covered from other discipline's minor buckets.
- Remaining three level 6.0 options are the advanced options where the student is given an opportunity to get extra qualification by earning some extra credits(18-20 extra credits). These three options are given below:
- Level 6.0: The **Bachelor's Engineering Degree with Honours** in chosen Major Engg./ Tech. Discipline i.e. in Electronics and Telecommunication Engineering with Honours with Multidisciplinary Minor (180-194 credits) enables students of Electronics and Telecommunication Engineering to take up five-six additional courses of 18 to 20 credits in the Electronics and Telecommunication Engineering discipline distributed over semesters III to VIII. The decision regarding the mechanism of distribution of these 18-20 credits over semesters III to VIII, which are over and above the min.160-max.176 Credits prescribed for the duration of four years will be taken by Academic Authorities of University. **Student must have CGPA equal to or greater than 7.5 at the end of second semester to go for this option**.
- Level 6.0: The **Bachelor's Engineering Degree with Research** in i.e. in Electronics and Telecommunication Engineering with Research with Multidisciplinary Minor (180-194 credits) enables students of Electronics and Telecommunication Engineering to take up a research project of 18 to 20 credits in the Electronics and Telecommunication Engineering discipline distributed over semesters VII to VIII. **Student must have CGPA equal to or greater than 7.5 at the end of sixth semester to go for this option**.
- Level 6.0: The **Bachelor's Engineering Degree in chosen Engg./ Tech. Discipline with Double Minor** (Multidisciplinary and Specialization Minor, 180-194 credits), i.e. "**B. Tech in Electronics and Telecommunication Engineering with *other selected discipline in* Engineering (as MDM) with Specialization Minor in Computer Engineering**" (180-194 credits) enables students to take up five-six additional courses of 14 credits in the discipline other than Electronics and Telecommunication Engineering(for completion of multidisciplinary minor) and 18 to

20 extra credits in the **Computer Engineering discipline** distributed over semesters III to VIII. Here, the ***other selected discipline*** **in Engineering should be different from Specialization Minor i.e. Computer Engineering**. This enables students to take up five-six or required additional courses of 18 to 20 credits in the **Computer Engineering** discipline distributed over semesters III to VIII, which are over and above the min.160-max.176 Credits. The decision regarding the mechanism of distribution of these 18-20 credits over semesters III to VIII, prescribed for the duration of four years will be taken by Academic Authorities of University. **Student must have CGPA equal to or greater than 7.5 at the end of second semester to go for this option**.

Semester-wise Credit distribution structure for Four Year UG Engineering Program - One Major, One Minor

Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course	BSC/ESC	06-08	08-10		--	--	--	--	--	14-18
Engineering Science Course		10-08	06-04		--	--	--	--	--	16-12
Programme Core Course (PCC)	Program Courses	--	02	08-10	08-10	10-12	08-10	04-06	04-06	44-56
Programme Elective Course (PEC)		--	--	--	--	04	08	02	06	20
Multidisciplinary Minor (MD M)	Multidisciplinary Courses		-	02	02	04	02	02	02	14
Open Elective (OE) Other than a particular program		--	--	04	02	02	--	--	--	08
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	02	02	--	02	--	02	--	--	08
Ability Enhancement Course (AEC -01, AEC-02)	Humanities Social Science and Management (HSSM)	02	--	--	02	--	--	--	--	04
Entrepreneurship/Economics/ Management Courses		--		02	02	--	--	--	--	04
Indian Knowledge System (IKS)			02		--	--	--	--	--	02
Value Education Course (VEC)		--	--	02	02	--	--	--	--	04
Research Methodology	Experiential Learning Courses	--	--	--	--	--	--		04	04
Comm. Engg. Project (CEP)/Field Project (FP)		--	--	02	--	--	--	-	-	02
Project		--	--	--	--	--	--		04	04
Internship/ OJT		--	---			--	--	12	-	12
Co-curricular Courses (CC)	Liberal Learning Courses	02	02		--	--	--	--	-	04
Total Credits (Major)		**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**160-176**

Student need to follow the Semester-wise Credit distribution structure for Four Year UG Engineering Program as prescribed in the table given above.

- There are seven vertical categories with specific credits distributed in specific semesters.
- Student can choose a Program Elective Course (PEC) in that specific semester from the given subjects.
- Multidisciplinary course(MDM) and Open Elective(OE) courses can be chosen from the MDM and OE Buckets depending on students choice. Completion of total credits given in the last column of the table for each vertical is mandatory.
- Students can complete 40% of the courses through online platforms like NPTEL/SWAYAM. The NPTEL SWAYAM course content should be at least 80% similar to the course content in the syllabus.

General Rules and Regulations

1. The normal duration of the course leading to B.Tech degree will be EIGHT semesters.

2. The normal duration of the course leading to M.Tech. degree will be FOUR semesters.

3. Each academic year shall be divided into 2 semesters, each of 20 weeks duration, including evaluation and grade finalization, etc. The Academic Session in each semester shall provide for at least 90 Teaching Days, with at least 40 hours of teaching contact periods in a five to six days session per week. The semester that is typically from Mid-July to November is called the ODD SEMESTER, and the one that is from January to Mid-May is called the EVEN SEMESTER. Academic Session may be scheduled for the Summer Session/Semester as well. For 1st year B. Tech and M. Tech the schedule will be decided as per the admission schedule declared by Government of Maharashtra.

4. The schedule of academic activities for a Semester, including the dates of registration, mid-semester examination, end-semester examination, inter-semester vacation, etc. shall be referred to as the Academic Calendar of the Semester, which shall be prepared by the Dean (Academic), and announced at least TWO weeks before the Closing Date of the previous Semester.

5. The Academic Calendar must be strictly adhered to, and all other activities including co-curricular and/or extra -curricular activities must be scheduled so as not to interfere with the Curricular Activities as stipulated in the Academic Calendar.

Registration:

1. Lower and Upper Limits for Course Credits Registered in a Semester, by a Full- Time Student of a UG/PG Programme:

A full time student of a particular UG/PG programme shall register for the appropriate number of course credits in each semester/session that is within the minimum and maximum limits specific to that UG/PG programme as stipulated in the specific Regulations pertaining to that UG/PG programme.

2. Mandatory Pre-Registration for higher semesters: In order to facilitate proper planning of the academic activities of a semester, it is essential for the every institute to inform to Dean (Academics) and COE regarding details of total no. of electives offered (Course-wise) along with the number of students opted for the same. This information should be submitted within two weeks from the date of commencement of the semester as per academic calendar.
3. PhD students can register for any of PG/PhD courses and the corresponding rules of evaluation will apply.
4. Under Graduate students may be permitted to register for a few selected Post Graduate courses, in exceptionally rare circumstances, only if the DUGC/DPGC is convinced of the level of the academic achievement and the potential in a student.

Course Pre-Requisites:

1. In order to register for some courses, it may be required either to have exposure in, or to have completed satisfactorily, or to have prior earned credits in, some specified courses.
2. Students who do not register on the day announced for the purpose may be permitted LATE REGISTRATION up to the notified day in academic calendar on payment of late fee.
3. REGISTRATION IN ABSENTIA will be allowed only in exceptional cases with the approval of the Dean (Academic) / Principal.
4. A student will be permitted to register in the next semester only if he 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 semesters;
   iii) Paid all required advance payments of the Institute and hostel for the current semester;
   iv) Not been debarred from registering on any specific ground by the Institute.

Evaluation System:

1. Absolute grading system based on absolute marks as indicated below will be implemented from academic year 2023-24, from I year B. Tech.

Percentage of marks	Letter Grade	Grade Point

91-100	EX	10.0
86-90	AA	9.0
81-85	AB	8.5
76-80	BB	8.0
71-75	BC	7.5
66-70	CC	7.0
61-65	CD	6.5
56-60	DD	6.0
51-55	DE	5.5
40-50	EE	5.0
<40	EF	0.0

2. Class is awarded based on CGPA of all eighth semester of B.Tech Program.

CGPA for pass is minimum 5.0	
CGPA upto <5.50	Pass class
CGPA ≥ 5.50&<6.00	Second Class
CGPA ≥ 6.00&<7.5	First Class
CGPA >7.50	Distinction
[Percentage of Marks =CGPA*10.0]	

3. A total of 100 Marks for each theory course are distributed as follows:

Mid Semester Exam (MSE) Marks	20
Continuous Assessment Marks	20
End Semester Examination(ESE)Marks	60

4. A total of 100 Marks for each practical course are distributed as follows

1.	Continuous Assessment Marks	40

2.	End Semester Examination (ESE)Marks	60

- It is mandatory for every student of B. Tech to score a minimum of 40 marks out of 100, M. Tech to score a minimum of 45 marks out of 100 with a minimum of 20 marks out of 60 marks in End Semester Examination for theory course.
- This will be implemented from the first year of B. Tech starting from Academic Year 2023-24

5. Description of Grades

EX Grade: An 'EX' grade stands for outstanding achievement.

EE Grade: The 'EE' grade stands for minimum passing grade.

The students may appear for the remedial examination for the subjects he/she failed for the current semester of admission only and his/her performance will be awarded with EE grade only.

If any of the students remain absent for the regular examination due to genuine reason and the same will be verified and tested by the Dean (Academics) or committee constituted by the University Authority.

FF Grade: The 'FF' grade denotes very poor performance, i.e. failure in a course due to poor performance .The students who have been awarded 'FF' grade in a course in any semester must repeat the subject in next semester.

6. Evaluation of Performance

a. Semester Grade Point Average (SGPA)

The performance of a student in a semester is indicated by Semester Grade Point Average (SGPA) which is a weighted average of the grade points obtained in all the courses taken by the student in the semester and scaled to a maximum of 10. (SGPI is to be calculated up to two decimal places). A Semester Grade Point Average (SGPA) will be computed for each semester as follows:

$$SGPA = \frac{[\sum_{i=1}^{n} c_i g_i]}{[\sum_{i=1}^{n} c_i]}$$

Where

'n' is the number of subjects for the semester,

'c_i' is the number of credits allotted to a particular subject, and

'g_i' is the grade-points awarded to the student for the subject based on his performance as per the above table.

SGPA will be rounded off to the second place of decimal and recorded as such.

b. Cumulative Grade Point Average (CGPA):

An up to date assessment of the overall performance of a student from the time he entered the Institute is obtained by calculating Cumulative Grade Point Average

(CGPA) of a student. The CGPA is weighted average of the grade points obtained in all the courses registered by the student since s/he entered the Institute. CGPA is also calculated at the end of every semester (upto two decimal places).Starting from the first semester at the end of each semester (S), a Cumulative Grade Point Average (CGPA) will be computed as follows:

$$CGPA = \frac{[\sum_{i=1}^{m} c_i g_i]}{[\sum_{i=1}^{m} c_i]}$$

Where,

'm' is the total number of subjects from the first semester onwards up to and including the semester S,

'ci' is the number of credits allotted to a particular subject, and

'gi' is the grade-points awarded to the student for the subject based on his/her performance as per the above table.

CGPA will be rounded off to the second place of decimal and recorded as such.

7. Attendance Requirements:

a. All students must attend every lecture, tutorial and practical classes.

b. To account for approved leave of absence (eg. representing the Institute in sports, games or athletics; placement activities; NCC/NSS activities; etc.) and/or any other such contingencies like medical emergencies, etc., the attendance requirement shall be a minimum of 75% of the classes actually conducted. If the student failed to maintain 75% attendance, he/she will be detained for appearing the successive examination. The Dean (Academics)/ Principal is permitted to give 10% concession for the genuine reasons as such the case may be. In any case the student will not be permitted for appearing the examination if the attendance is less than 65%.

c. The course instructor handling a course must finalize the attendance 3 calendar days before the last day of classes in the current semester and communicate clearly to the students by displaying prominently in the department and also in report writing to the head of the department concerned.

d. The attendance records are to be maintained by the course instructor and he shall show it to the student, if and when required.

8. Transfer of Credits:

The courses credited elsewhere, in Indian or foreign University/Institutions/ Colleges/Swayam Courses by students during their study period at DBATU may count towards the credit requirements for the award of degree. The guidelines for such transfer of credits are as follows:

a. 20 % of the total credit will be considered for respective calculations.

b. Credits transferred will be considered for overall credits requirements of the programme.
c. Credits transfer can be considered only for the course at same level i.e UG, PG etc.
d. A student must provide all details (original or attested authentic copies) such as course contents, number of contact hours, course instructor /project guide and evaluation system for the course for which he is requesting a credits transfer. He shall also provide the approval or acceptance letter from the other side. These details will be evaluated by the concerned Board of Studies before giving approval. The Board of Studies will then decide the number of equivalent credits the student will get for such course(s) in DBATU. The complete details will then be forwarded to Dean for approval.
e. A student has to get minimum passing grades/ marks for such courses for which the credits transfers are to be made.
f. Credits transfers availed by a student shall be properly recorded on academic record(s) of the student.
g. In exceptional cases, the students may opt for higher credits than the prescribed.

Course Structure for Electronics and Telecommunication Engineering

	Course Code	Course Title	L	T	P	Cr	Categorization
SEM-I	23UD1000BS101	Engineering Mathematics-I	3	1	0	4	BSC
	23UD1CHEBS102	Engineering Chemistry	3	0	0	3	BSC
	23UD1CHEBS103L	Engineering Chemistry Lab	0	0	2	1	BSC
	23UD1MECES104	Engineering Mechanics	3	0	0	3	ESC
	23UD1MECES105L	Engineering Mechanics Lab	0	0	2	1	ESC
	23UD1000ES106	Basic Electrical & Electronics Engineering	2	1	0	3	ESC
	23UD1000ES107L	Basic Electrical & Electronics Engineering Lab	0	0	2	1	ESC
	23UD1EEEES108	Environmental Science and Engineering	1	0	0	1	ESC
	23UD1EEEES109L	Environmental Science and Engineering Lab	0	0	2	1	ESC
	23UD1000VS110L	Workshop Practices	0	0	4	2	VSEC
	23UD1372VS110	Design Thinking	2	0	0	2	VSEC
	23UD1000CC111A	NSS-I	1	0	2	2	CC
	23UD1000CC111B	NCC					
	23UD1000CC111C	Introduction to Yoga					
		Total	**15**	**2**	**14**	**24**	
SEM-	23UD1000BS201	Engineering Mathematics-II	3	0	0	3	BSC

II	23UD2PHYBS202	Engineering Physics	0	0	2	1	BSC
	23UD2PHYBS203L	Engineering Physics Lab	3	1	0	4	BSC
	23UD2EGDES204	Engineering Graphics and Design	2	0	0	2	ESC
	23UD2EGDES205L	Engineering Graphics and Design Lab	0	0	2	1	ESC
	23UD1000ES206	Programming for problem solving	2	0	0	2	ESC
	23UD1000ES207L	Programming for problem Solving Lab	0	0	2	1	ESC
	23UD1372PC208	Consumer Electronics	2	0	0	2	PCC
	23UD1000VS209	Communication Skills	2	0	0	2	AEC/VEC/IKS
	23UD1000VS210L	Communication Skills Lab	0	0	2	1	AEC/VEC/IKS
	23UD1000IK211	IKS Bucket*	2	0	0	2	AEC/VEC/IKS
	23UD1000CC212A/B/C/D	A. NSS-II B. Health & Wellness C. Study from Still Life D. Hindustani Music	1	0	2	2	CC
		Total	**17**	**1**	**10**	**23**	

Exit option with: * Consumer Electronic/Radio Engineering /Digital Electronics (Internship of 6 weeks in any one), * Electronics Servicing and Maintenance, *Course on word processing, spreadsheets and power point presentations.

SEMESTER I

23UD1000BS101	Engineering Mathematics –I	04 Credits

Course Objectives:

1. To know the application of the matrix technique (Linear algebra) to find solutions of system of linear equations arising in many engineering problem.
2. To know and apply the concept partial derivatives and their applications to Maxima/ Minima, series expansion of multi valued functions.
3. To understand Computation of Jacobian of functions of several variables and their applications to engineering problems.
4. To identify and sketch of curves in various coordinate system.
5. To evaluate multiple integrals and their applications to area and volume.

Course Outcomes:

Students will be able to:

CO1: Apply the matrix technique (Linear algebra) to find solutions of system of linear equations arising in many engineering problem.

CO2: Demonstrate the concept partial derivatives and their applications to Maxima/ Minima, series expansion of multi valued functions.

CO3: Compute Jacobian of functions of several variables and their applications to engineering problems.

CO4: Identify and sketch of curves in various coordinate system.

CO5: Evaluate multiple integrals and their applications to area and volume.

Unit 1: Linear Algebra- Matrices

Inverse of a matrix by Gauss-Jordan method; Rank of a matrix; Normal form of a matrix ; Consistency of non- homogeneous and homogeneous system of linear equations ; Eigen values and eigen vectors ; Properties of eigen values and eigen vectors (without proofs); Cayley-Hamilton's theorem (without proof) and its applications.

Unit 2: Partial Differentiation

Partial derivatives of first and higher orders; Homogeneous functions – Euler's Theorem for functions containing two and three variables (with proofs); Total derivatives; Change of variables.

Unit 3: Applications of Partial differentiation

Jacobians-properties; Taylor's and Maclaurin's theorems (without proofs) for functions of two variables; Maxima and minima of functions of two variables; Lagrange's method of undetermined multipliers.

Unit 4: Reduction Formulae and Tracing of Curves

Reduction formulae for $\int_0^{\frac{\pi}{2}} sin^n x\, dx, \int_0^{\frac{\pi}{2}} cos^n x\, dx, \int_0^{\frac{\pi}{2}} sin^m x\, cos^n x dx,$ tracing of standard curves given in cartesian, parametric and polar forms.

Unit 5: Multiple Integra

Double integration in Cartesian and polar co-ordinates; Evaluation of double integrals by changing the order of integration and changing to polar form; Triple integral; Applications of multiple integrals to find area as double integral , volume as triple integral and surface area.

Text Books

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, NewDelhi.
2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, NewYork.
3. A Course in Engineering Mathematics (Vol I) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan,Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.

Reference Books

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2. A Text Book of Engineering Mathematics by Peter O‟ Neil, Thomson Asia Pte Ltd. , Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.

General Instructions:

1. The tutorial classes in Engineering Mathematics-I are to be conducted batchwise.
2. Each class should be divided into three batches for the purpose.
3. The internal assessment of the students for 20 marks will be done based on assignments, surprise tests, quizzes, innovative approach to problem solving and percentage attendance.
4. The minimum number of assignments should be eight covering all topics.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course	Name Instructor	Host Institute
1.	Engineering Mathematics –I	Prof. Jitendra Kumar	IIT Kharagpur

23UD1CHEBS102	Engineering Chemistry	03 Credits

Course Objectives:

1. To impart the knowledge of chemistry in the area of Engineering and Technology.
2. To capable the student to explain the importance of chemistry in various fields of Engineering.
3. To identify the concept of chemistry to lay the ground work for subsequent studies.

Course Outcomes:

Students will be able to:

CO1: Students should be able to understand and explain the basic concepts of Water treatment and capable to explain softening processes and water Characteristics.

CO2: Students should be able to classify and explain various types of Corrosion and should apply methods to minimize the rate of Corrosion.

CO3: Students should be able to classify and explain various types of coals and lubricants, its physical and chemical properties and industrial importance.

CO4: Students should know the concept of Electrochemistry and its importance.

CO5: Student should be able to understand and explain various instrumental methods of Analysis.

Unit 1: Water Treatment

Introduction, Hard and soft water, Disadvantages of hard water, Softening of water – Ion exchange process, Hot lime –soda process, Hardness and its determination by EDTA method, Dissolved oxygen (DO) and its determination by Winkler's method, Numerical based on hardness, Sewage water treatment.

Unit 2: Corrosion and its Control

Introduction, Fundamental reason of corrosion, Electrochemical corrosion (Wet Corrosion), Mechanism of Wet corrosion, Direct Chemical corrosion (Dry corrosion), Factors affecting the rate of corrosion, Types of corrosion-Pitting corrosion, Microbiological corrosion, Methods to minimize the rate of corrosion- Proper designing, Cathodic and anodic protection method.

Unit 3: Fuels and Lubricants

Fuels: Introduction, Classification of fuel, Calorific value of a fuel, Characteristics of a good fuel, Solid fuel- Coal and various types of coal, Analysis of coal- Proximate and Ultimate analysis, Liquid fuel- Refining of petroleum.

Lubricants: Introduction, classification of lubricants - Solid, Semi –solid and Liquid lubricants, Properties of lubricants: Physical properties – viscosity, viscosity index, surface tension, Flash point and Fire point. Chemical properties – acidity, saponification value.

Unit 4: Electrochemistry

Introduction, Electrical conductance, Conductance measurement by Wheatstone bridge method, Cell constant, Conductometric titrations, Glass electrode and its application for pH measurement, Ostwald's theory of acid- base indicator, Rechargeable batteries i) Lithium ion battery, ii) Lithium battery, Fuel cell (H2-O2), Advantages of fuel cell.

Unit 5: Instrumental Methods of Analysis

UV-Visible spectroscopy-Introduction, Laws of absorption -Beer's - Lambert's law, Instrumentation and working of double beam spectrophotometer.

Flame Photometry (Flame emission spectroscopy) - Introduction, Principle and working. Chromatography- Introduction, Classification, Thin layer chromatography (TLC).

Brief discussion on IR spectroscopy.

Textbooks:

1. Jain P.C & Jain Monica, Engineering Chemistry, Dhanpat Rai& Sons, Delhi, 1992.
2. Bhal &Tuli, Text book of Physical Chemistry, S. Chand & Company, New Delhi.
3. Shikha Agarwal, Engineering Chemistry- Fundamentals and applications, Cambridge Publishers - 2015.
4. Gurudeep Chatwal and Sham Anand, Instrumental methods of Chemical Analysis, Himalaya Publishing House, New Delhi

Reference books:

1. Barrow G.M., Physical Chemistry, McGraw-Hill Publication, New Delhi.
2. O. G. Palanna , Engineering Chemistry, Tata McGraw-Hill Publication, New Delhi.
3. WILEY, Engineering Chemistry, Wiley India, New Delhi 2014.
4. S.S.Dara, Engineering Chemistry, McGraw Hill Publication, New Delhi.
5. Willard, Hobart H.; Merritt, Lynne L., Jr.; Dean, John A. Instrumental Methods of Analysis, American Chemical Society.

23UD1CHEBS103L	Engineering Chemistry Lab	01 Credit

List of Experiments: (Perform any 9 – 10 Experiments)

1. Determination of Hardness of water sample by EDTA method.
2. Determination of Chloride content in water sample by precipitation titration method.
3. Determination of Dissolve Oxygen in water by Iodometric method.
4. Determination of Percent purity of Bleaching Powder.
5. pH – metric Titration (Acid Base titration)
6. Conductometric Titration (Acid Base titration)
7. Surface tension

8. Viscosity
9. To determine Acidity of water sample.
10. To determine Calorific value of a fuel.
11. Determination of Acid value of an oil sample.
12. Determination of Saponification value of an oil sample.
13. To verify Beer's-Lambert's law.
14. To determine Alkalinity water sample.
15. Determination of rate of corrosion of metal.
16. To determine the maximum wavelength of absorption of a given solution by colorimeter.
17. Experiment on Chromatography.

Reference Books:

1. Systematic experiments in Chemistry, A. Sethi, New Age International Publication, and New Delhi.
2. Practical Inorganic Chemistry, A. I. Vogel, ELBS Pub.
3. Practical in Engineering Chemistry, S. S. Dara.

23UD1MECES104	Engineering Mechanics	03 Credits

Course Objective:

1. To know and apply fundamental Laws of Engineering Mechanics
2. To know and apply Conditions of static equilibrium to analyze given force system
3. To compute Centre of gravity and Moment of Inertia of plane surfaces
4. To compute the motion characteristics of a body/particle for a Rectilinear and Curvilinear Motion
5. To know and discuss relation between force and motion characteristics

Course Outcomes:

Students will be able to:

CO1: Apply fundamental Laws of Engineering Mechanics
CO2: Apply Conditions of static equilibrium to analyze given force system.
CO3: Compute Centre of gravity and Moment of Inertia of plane surfaces
CO4: Compute the motion characteristics of a body/particle for a Rectilinear and Curvilinear Motion
CO5: Know and discuss relation between force and motion characteristics

Unit 1: Basic Concepts

Objectives of Engineering Analysis and Design, Idealization of Engineering Problems, Simplification of real 3D problems to 2-D and 1-D domain, Basis of Assumptions, types of supports, types of load, free body diagram, Laws of Motion, Fundamental principles, Resolution and composition of a forces, Resultant, couple, moment, Varigno's theorem, force systems, Centroid of composite shapes, moment of inertia of planer sections and radius of gyration.

Unit 2: Equilibrium

Static equilibrium, analytical and graphical conditions of equilibrium, Lami's theorem, equilibrium of coplanar concurrent forces, coplanar non concurrent forces, parallel forces, beams reactions Simple trusses (plane and space), method of joints for plane trusses, method of sections for plane trusses Friction: Coulomb law, friction angles, wedge friction, sliding friction and rolling resistance

Unit 3: Kinematics

Types of motions, kinematics of particles, rectilinear motion, constant and variable acceleration, relative motion, motion under gravity, study of motion diagrams, angular motion, tangential and radial acceleration, projectile motion, kinematics of rigid bodies, concept of instantaneous center of rotation, concept of relative velocity

Unit 4: Kinetics

Mass moment of inertia, kinetics of particle, D'Alembert's principle: applications in linear motion, kinetics of rigid bodies, applications in translation, applications in fixed axis rotation

Unit 5: Work, Power, Energy

Principle of virtual work, virtual displacements for particle and rigid bodies, work done by a force, spring, potential energy, kinetic energy of linear motion and rotation, work energy equation, conservation of energy, power, impulse momentum principle, collision of elastic bodies.

Reference Books:

1. S. Timoshenko, D. H. Young, "Engineering Mechanics", McGraw Hill,1995
2. Tayal A. K., "Engineering Mechanics", Umesh Publications,2010.
3. Bhavikatti S. S., Rajashekarappa K. G., "Engineering Mechanics", New Age International Publications, 2ndEdition
4. Beer, Johnston, "Vector Mechanics for Engineers", Vol. 1: Statics and Vol. 2: Dynamics, McGraw Hill Company Publication, 7th edition,1995.
5. Irving H. Shames, "Engineering Mechanics - Statics and Dynamics", Pearson Educations, Fourth edition, 2003.
6. McLean, Nelson, "Engineering Mechanics", Schaum"s outline series, McGraw Hill Book Company, N. Delhi, Publication.
7. Singer F. L., "Engineering Mechanics - Statics & Dynamics", Harper and Row Pub. York
8. Khurmi R. S., "Engineering Mechanics", S. Chand Publications, N. Delhi

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course	Name Instructor	Host Institute
1.	Engineering Mechanics	Prof. K. Ramesh	IIT Madras

23UD1MECES105L	Engineering Mechanics Lab	01 Credits

Atleast 10 experiments should be performed from the following list.

List of Experiments:

1. Polygon law of coplanar forces
2. Bell crank lever.
3. Support reaction for beam.
4. Problems on beam reaction by graphics statics method
5. Simple / compound pendulum.
6. Inclined plane (to determine coefficient of friction).
7. Collision of elastic bodies (Law of conservation of momentum).
8. Moment of Inertia of fly wheel.
9. Verification of law of Machine using Screw jack
10. Assignment based on graphics statics solutions
11. Any other innovative experiment relevant to Engineering Mechanics.
12. Centroid of irregular shaped bodies.
13. Verification of law of Machine using Worm and Worm Wheel
14. Verification of law of Machine using Single and Double Gear Crab.
15. Application of Spread sheet Program for concepts like law of moments, beam reactions, problems in kinematics, etc.

23UD1000ES106	Basic Electrical & Electronics Engineering	03 Credits

Course Objectives:

1. To know and apply basic ideas and principles of electrical engineering.
2. To Identify protection equipment and energy storage devices.
3. To differentiate electrical and electronics domains and explain the operation of diodes and transistors.
4. To acquire knowledge of digital electronics
5. To design simple combinational and sequential logic circuits.

Course Outcomes:

Students will be able to:

CO1: Apply basic ideas and principles of electrical engineering.
CO2: Identify protection equipment and energy storage devices.
CO3: Differentiate electrical and electronics domains and explain the operation of diodes and transistors.
CO4: Acquire knowledge of digital electronics
CO5: Design simple combinational and sequential logic circuits.

Unit 1: Elementary Electrical Concepts:

Fundamental of Electrical system Potential difference, Ohm's law, Effect of temperature on resister, resistance temperature coefficient, Electrical wiring system: Study of different wire gauges and their applications in domestic and industry. Energy Resources and Utilization: Conventional and nonconventional energy resources; Introduction to electrical energy generation from different resources, transmission, distribution and utilization, Advantages & Disadvantages of AC & DC transmission. Concept of Supply Demand, Power Factor, Need of unity factor.

Unit 2: Measurement of Electrical Quantities:

Measurement of Voltage, Current, and Power; Measurement of 3 phase power; Study of Energy meters. Study of Electrical Storage devices: Batteries such as Nickel-cadmium (NiCd), Lithium- ion (Li-ion), Lithium Polymer (Li-pol.) batteries. Study of circuit breakers & Actuators (MCB & MPCB, Power Contactors & Aux contactors, Electro-Mechanical & Solid state Relays)

Unit 3: Diodes and Circuits:

The P-N Junction Diode, V-I characteristics, Diode as Rectifier, specifications of Rectifier Diodes, Half Wave, Full wave, Bridge rectifiers, Equations for I_{DC},V_{DC},V_{RMS}, I_{RMS}, Efficiency and Ripple Factor for each configuration. Filters: Capacitor Filter, Choke Input Filter, Capacitor Input Filter (Π Filter), Zener Diode, Characteristics, Specifications, Zener Voltage Regulator and Types of Diodes: LED, Photodiode

Unit 4: Semiconductor Devices and Applications:

Transistors: Introduction, Classification, CE, CB, and CC configurations, α, β, concept of gain and bandwidth. Operation of BJT in cut-off, saturation and active regions (DC analysis). BJT as an amplifier, biasing techniques of BJT, BJT as a switch.

Introduction to Digital Electronics: Number System, Basic logic Gates, Universal Gates, Boolean Postulates, De-Morgan Theorems

Reference/Text Books:

1. V. N. Mittal and Arvind Mittal, Basic Electrical Engineering, McGraw-Hill Publication.
2. Brijesh Iyer and S. L. Nalbalwar, A Text book of Basic Electronics, Synergy Knowledge ware Mumbai, 2017.ISBN:978-93-8335-246-3
3. Vincent DelToro, Electrical engineering Fundamentals, PHI Publication, 2nd Edition, 2011.
4. Boylstad, Electronics Devices and Circuits Theory, Pearson Education.
5. Edward Hughes, Electrical Technology, Pearson Education.
6. D. P. Kothari and Nagrath, Theory and Problems in Electrical Engineering, PHI Publication, 2011.
7. B. L. Theraja, Basic Electronics, S. Chand Limited, 2007.
8. Millman Halkias, Integrated Electronics-Analog and Digital Circuits and Systems, McGraw-Hill Publication, 2000.

9. Donald Neaman, Electronic Circuit Analysis and Design, McGraw-Hill Publication, 3rd Edition.
10. Donald Neaman, Electronic Circuit Analysis and Design, McGraw-Hill Publication, 3rd Edition.
11. Printed Circuit Boards Design &Technology, WalterC. Bosshart, McGraw-Hill Publication.

Note: Students are advised to use internet resources whenever required.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course	Name Instructor	Host Institute
1.	Basic Electrical Technology	Prof. N.K. De, Prof. G.D. Roy, Prof. T.K. Bhattacharya	IIT Kharagpur
2.	Basic Electronics and Lab	Prof. T.S. Natarajan	IIT Madras
3.	Basic Electronics	Prof. Mahesh B. Patil	IIT Bombay

23UD1000ES107L Basic Electrical & Electronics Engineering Lab 01 Credit

At least 08 experiments should be performed from the following list

List of Experiments:

1. Measure voltage current and power in 1 phase circuit with resistive load.
2. Measure voltage current and power in R L series circuit.
3. Determine transformation ratio (K) of 1 phase transformer
4. Connect single phase transformer and measure input output quantities.
5. Identify various passive electronic components in the given circuit.
6. Connect resistors, capacitors in series and parallel combination on bread board and measure its value using multimeter.
7. Identify various active electronic component in the given circuit.
8. Test the performance of PN junction diode.
9. Test the performance of Zener diode.
10. Test the performance of NPN transistor.

23UD1EEEES108 Environmental Science and Engineering 01 Credits

Course Objectives

1. To impart the knowledge of environmental education to the students of Engineering and Technology.
2. To explain basic knowledge and concept of causes, effects and control measures of environmental pollution and
3. To understand the role of individual for the protection of Environment.

Course Outcomes

Student should able to:

1. Know and understand about components and segments of environment, ecosystem and its types.
2. Understand and explain various types of air pollution, their effects and control measures.
3. know the various types of water pollution, sources, waste water treatment, effect of water pollution on health
4. understand the sources, effects and control measures of soil & noise pollution
5. Know the sources and types of solid waste, its management and role of individual in pollution prevention.

Unit 1- Environment

Introduction, Components of Environment, Types of Environment, Brief discussion on Segments of Environment, Environmental Pollution, Ecosystem-Types of Ecosystem, Components of Ecosystem.

Unit 2- Air Pollution

Introduction, Brief discussion on air pollutants, Sources of Air Pollution- Pollutants from Industry, Pollution by Automobiles; Effect of Air Pollutions-Acid rain, Green House Effect, Global warming; Brief discussion on Control of Air Pollution.

Unit 3- Water Pollution

Introduction, Types of Water Pollutants, Sources of Water Pollution, Methods to remove impurities in water, Treatment of Waste water, Impact of Water Pollution on Human Health, Water as a carrier for the transmission of diseases.

Unit 4- Soil & Noise Pollution

Sources of Soil Pollution, Harmful effects of Soil Pollution, Control of Soil Pollution, Noise Pollution- Sources, Effects and Control Measures of Noise Pollution.

Unit 5- Solid Waste Management

Classification of Solid waste- Sources and Types of Solid Waste, Causes of Solid Waste Solid Waste Management- Disposal of Solid Waste, Recycling of Solid Waste Awareness of Environment, Role of Individuals in Pollution Prevention.

Reference Books:

1. Environmental Science, V. K. Ahluwalia and Sunita Malhotra
2. Environmental Chemistry (sixth edition), A. K. De
3. Essential Environmental Studies, S. P. Mishra and S. N. Pandey

23UD1EEEES109L	Environmental Science and Engineering	01 Credits

List of Experiments:

1. Experiments on Air Pollution.
2. Experiments on Water Pollution.
3. Experiments on Soil Pollution.

Reference Books:

1. Environmental Chemistry (sixth edition), A. K. De
2. A Textbook of Engineering Chemistry, Dr. S. S. Dara and Dr. S. S. Umare
3. Textbook On Experiments & Calculations In Engineering Chemistry: Ss Dara (Author), S Chand & Company Pvt Ltd - He (Publisher)

23UD1000VS110L	Workshop Practices	02 Credits

Course Objectives:

1. To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.
2. To have a study and hands-on-exercise on plumbing and carpentry components.
3. To have a practice on gas welding, foundry operations and fitting.
4. To have a study on measurement of electrical quantities, energy and resistance to earth.
5. To have a practice on soldering.

Laboratory Outcomes:

Students will be able to:

1. Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
2. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
3. By assembling different components, they will be able to produce small devices of their interest.

Workshop Practices

1. Machine shop
2. Fitting shop
3. Carpentry

4. Electrical & Electronics
5. Welding shop
6. Casting
7. Smithy
8. Plastic moulding& Glass Cutting

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Text/Reference Books:

1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual) ISBN: 978-93-91505-332.
2. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
3. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
4. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
5. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
6. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

23UD1372VS110	Design Thinking	02 Credits

Course Objective:

The objective of this Course is to provide the new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products which useful for a student in preparing for an engineering career.

Course Outcomes (CO):

Students will be able to:

CO1: Compare and classify the various learning styles and memory techniques and apply them in their engineering education.

CO2: Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products.

CO3: Develop new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing innovative products.

CO4: Propose real-time innovative engineering product designs and Choose appropriate frameworks, strategies, techniques during prototype development.

CO5: Perceive individual differences and its impact on everyday decisions and further create a better customer experience.

COURSE CONTENTS:

Unit 1: An Insight to Learning and Remembering Memory
Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting, Understanding the Memory process, Problems in retention, Memory enhancement techniques

Unit 2: Emotions and Basics of Design Thinking
Understanding Emotions: Experience & Expression, Assessing Empathy, Application with Peers, Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) –Empathize, Define, Ideate, Prototype, Test.

Unit 3: Problem Fixing and Process of Product Design
Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving, Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design, Examples of best product designs and functions, Assignment – Engineering Product Design.

Unit 4: Prototyping & Testing
What is Prototype? Why Prototype? Rapid Prototype Development process, Testing, Sample Example, Test Group Marketing.

Unit 5: Design Thinking & Customer Centricity
Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product Design.

Text books:
1. Karmic Design Thinking by Prof. Bala Ramadurai,

References:
1. Design: Creation of Artifacts in Society by Prof. Karl Ulrich, U. Penn
2. Change by Design by Tim Brown.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course	Name Instructor	Host Institute
1.	Understanding Design Thinking and People Centred Design	Prof. Jhumkee Iyengar	IIT Kanpur

23UD1000CC111A	NSS-I	02 Credits

Unit 1: Introduction and Basic Concepts of NSS

History, Philosophy, Aims & objectives of NSS Organizational structure, Concept of regular activities, Special camping, Day Camps. Basis of adoption village/slums, Methodology of conducting Survey.

Unit 2: Youth and community mobilization
Definition, Profile of youth, Categories of youth, Issues, Challenges and opportunities for youth, Youth as an agent of social change, Youth-adult partnership, Mapping of community stakeholders, Identifying methods of mobilization, Needs & importance of volunteerism.

Unit 3: Importance and Role of Youth Leadership
Meaning and types of leadership, Qualities of good leaders; Traits of leadership, Importance and role of youth leadership.

23UD1000CC111B	**NCC**	**02 Credits**

23UD1000CC111C	**Introduction to Yoga**	**02 Credits**

Course Objectives:

4. To learn Message of Vedas and Upanishads
5. To learn Four Streams of Yoga,
6. To learn Shaddarshanas or the SIX systems of Indian Philosophy,
7. To introduce with Hatha Yoga and Patanjali Yoga Sutras
8. To understand Life and message of spiritual masters and Indian Culture
9. To understand Anatomy and Physiology, Yoga and Exercise Physiology

Course Outcomes:

CO1: Students should be able to learn Message of Vedas And Upanishads
CO2: Students should be able to learn Four Streams of Yoga,
CO3: Students should be able to learn Shaddarshanas or the SIX systems of Indian Philosophy,
CO4: Students should be able to introduce with Hatha Yoga and Patanjali Yoga Sutras
CO5: Students should be able to understand Life and message of spiritual masters and Indian Culture
CO6: Students should be able to understand Anatomy and Physiology, Yoga and Exercise Physiology

Unit 1:
Message of Vedas and Upanishads: Search for Happiness, Search for Reality

Unit 2:
Streams of Yoga: Bhakti Yoga, Raja Yoga - Antaranga Yoga, Bahiranga Yoga, Karma Yoga -Secrets of Action, Jnana Yoga

Unit 3:
Shaddarshanas – Nyaya, Vaishesika, Sankhya, Uttaramimamsa, Purvamimamsa

Unit 4:
Life and Message of Spiritual Masters –Sri Ramakrishna Paramahamsa, Maa Sharada Devi, Swami Vivekananda, Indian Culture

Unit 5:
Anatomy and Physiology, Yoga and Exercise Physiology, Yoga & Health - Concept of Health and Pancha Kosha Vivek, Yogic Concept of Health and Disease

Reference:

1. NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Introduction to Yoga and Applications of Yoga	Prof. Sridhar Melukote	Swami Vivekananda Yoga Anusandhana Samsthan

SEMESTER II

23UD2PHYBS202	Engineering Physics	03 Credits

Course Objectives:

1. To provide a firm grounding in the basic physics principles and concept to resolve many Engineering and technological problems.
2. To understand and study the Physics principles behind the developments of engineering materials.

Course Outcomes:

Students will be able to:

CO1: Students acquired basic knowledge of differential equation and can create wave equation and analysis of the intensity variation of light due to interference and polarization. Students are able to understand the light propagation in fibre and use of Laser in Science and engineering.

CO2: Students can apply the knowledge of quantum mechanics to set Schrödinger's equations.

CO3: Students will familiar with some of the basic laws related to electromagnetism and Maxwell's equation as well as properties of dielectrics.

CO4: Students are able to understand key principle and application of nuclear physics. Identify planes in crystal and characteristics measurements of cubic system.

CO5: Students are able to explain fundamental concepts of magnetism and they should analyze the properties of semiconducting materials and describe various applications of superconductor.

Unit 1:

Engineering Optics: Interference: in thin film due to reflected light, wedge shaped film, Newton' Rings, Applications, Polarization: types of polarization, optical activity, specific rotation and Laurentz half shade polarimeter, Lasers: characteristics, Gas Laser, solid state Laser and semiconductor lasers, Applications of Lasers, Optical fibres: Acceptance cone, Numerical aperture, applications, Oscillations: free oscillations, forced oscillations and damped oscillation, resonance and it's condition.

UNIT-2:

Quantum Mechanics: Wave and particle duality of radiation – de Broglie concept of matter waves – Wave function and its physical significance, Heisenberg's uncertainty principle and it's application – Schrodinger's wave equation – eigen values and eigen functions, particle confined in one dimensional infinite square well potential, Introduction to quantum computing.

UNIT-3:

Electromagnetism: Differential and integral calculus: Operator, Concept of gradient, divergence and curl, Ampere's law, Faraday law, Gauss–Divergence theorem, integral and differential forms of Maxwell equations and their physical significance, EM waves in free space. Dielectrics: polarization, Types of Dielectric polarization, dielectric constant, polar - non polar dielectrics.

UNIT-4:

Crystal Structure: Fundamental concepts, Crystal systems Cubic structure: Number of atoms, co-ordination number, packing fraction, Atomic radius, Miller indices, relation between '〉' and 'a'

Nuclear Physics**:** Nuclear properties Introduction to mass defect & packing fraction, Nuclear reaction: Q value of Nuclear reaction,- Radioactivity – properties of 〈, ® and © rays, GM Counter.

UNIT-5:

Physics of Advanced Materials: Types of magnetic materials, ferrites and garnets, magnetic domain and hysteresis curve, Semiconductors, conductivity of semiconductors, Hall Effect Superconductors: definition – Meissner effect – type I & II superconductors, Nanomaterials: introduction and properties – synthesis: top-down and bottom-up approach, Introduction to SCADA, XRD, FESEM, VSM and applications.

Text books:

1. Introduction to Electrodynamics –David R. Griffiths.
2. Concept of Modern Physics – Arthur Beizer. Tata McGraw-Hill Publishing Company Limited.
3. Optics –Ajoy Ghatak. MacGraw Hill Education (India) Pvt. Ltd.
4. Science of Engineering Materials- C.M. Srivastava and C. Srinivasan. New Age International Pvt.Ltd.
5. Solid State Physics – A.J. Dekker. McMillan India –Limited.
6. The Feynman Lectures on Physics Vol I, II, III.
7. Introduction to Solid State Physics – Charles Kittel. John Willey and Sons
8. Engineering Physics – M.N. Avadhanulu and P.G. Kshirsagar.S.Chand and Company LTD.
9. Engineering Physics - R.K. Gaur andS. L. Gupta. Dhanpat Rai Publications Pvt. Ltd.-New Delhi.
10. Fundamental of Physics - Halliday and Resnik. Willey Eastern Limited.
11. Nanotechnology: An Introduction to Synthesis, Properties and Applications of Nanomaterials- Thomas Varghese , K. M. Balakrishna

23UD2PHYBS203L	Engineering Physics Lab	01 Credit

At least 08 experiments should be performed from the following list.

1. Newton’s rings - Determination of radius of curvature of Plano convex lens / wavelength of light
2. Wedge Shaped film - Determination of thickness of thin wire
3. Half shade Polarimeter - Determination of specific rotation of optically active material
4. Laser - Determination of wavelength of He-Ne laser light
5. Magnetron Tube - Determination of ‘e/m’ of electron
6. G.M. Counter - Determination of operating voltage of G.M. tube
7. Crystal Plane – Study of planes with the help of models related Miller Indices
8. Hall Effect - Determination of Hall Coefficient
9. Four Probe Method - Determination of resistivity of semiconductor
10. Measurement of Band gap energy of Semiconductors
11. Experiment on fibre optics

12. B-H Curve Experiment
13. Experiments on SCADA

23UD2000BS201	Engineering Mathematics – II	04 Credits

Course Objectives:

1. To know and discuss the need and use of complex variables to find roots, to separate complex quantities and to establish relation between circular and hyperbolic functions.
2. To understand and solve first and higher order differential equations and apply them as a mathematical modelling in electric and mechanical systems.
3. To determine Fourier series representation of periodic functions over different intervals.
4. To demonstrate the concept of vector differentiation and interpret the physical and geometrical meaning of gradient, divergence &curl in various engineering streams.
5. To know and apply the principles of vector integration to transform line integral to surface integral, surface to volume integral &vice versa using Gree's, Stoke's and Gauss divergence theorems.

Course Outcomes:

Students will be able to:

CO1: Discuss the need and use of complex variables to find roots, to separate complex quantities and to establish relation between circular and hyperbolic functions.

CO2: Solve first and higher order differential equations and apply them as a mathematical modelling in electric and mechanical systems.

CO3: Determine Fourier series representation of periodic functions over different intervals.

CO4: Demonstrate the concept of vector differentiation and interpret the physical and geometrical meaning of gradient, divergence &curl in various engineering streams.

CO5: Apply the principles of vector integration to transform line integral to surface integral, surface to volume integral &vice versa using Green‟s, Stoke‟s and Gauss divergence theorems.

Unit 1: Complex Numbers

Definition and geometrical representation ; De-Moivre‟s theorem(without proof) ; Roots of complex numbers by using De-Moivre‟s theorem ; Circular functions of complex variable – definition ; Hyperbolic functions ; Relations between circular and hyperbolic functions ; Real and imaginary parts of circular and hyperbolic functions ; Logarithm of Complex quantities.

Unit 2: Ordinary Differential Equations of First Order and First Degree and Their Applications

Linear equations; Reducible to linear equations (Bernoulli's equation); Exact differential equations; Equations reducible to exact equations ; Applications to orthogonal trajectories , mechanical systems and electrical systems.

Unit 3: Linear Differential Equations with Constant Coefficients

Introductory remarks - complementary function, particular integral; Rules for finding complementary functions and particular integrals; Method of variation of parameters; Cauchy's homogeneous and Legendre's linear equations.

Unit 4: Fourier Series

Introductory remarks- Euler's formulae ; Conditions for Fourier series expansion – Dirichlet's conditions ; Functions having points of discontinuity ; Change of interval ; Odd and even functions expansions of odd and even periodic functions ; Half-rangeseries.

Unit 5: Vector Calculus

Scalar and vector fields:Gradient, divergence and curl; Solenoidal and irrotational vector fields; Vector identities (statement without proofs); Green's lemma, Gauss's divergence theorem and Stokes' theorem (without proofs).

Text Books

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, NewDelhi.
2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, NewYork.
3. A Course in Engineering Mathematics (Vol II) by Dr. B. B. Singh, Synergy Knowledge ware, Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.

Reference Books

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2. A Text Book of Engineering Mathematics by Peter O" Neil, Thomson Asia Pte Ltd. , Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.

General Instructions:

1. The tutorial classes in Engineering Mathematics-II are to be conducted batchwise. Each class should be divided into three batches for the purpose.
2. The internal assessment of the students for 20 marks will be done based on assignments, surprise tests, quizzes, innovative approach to problem solving and percentage attendance.
3. The minimum number of assignments should be eight covering all topics.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Engineering Mathematics II	Prof. Jitendra Kumar	IIT Kharagpur

23UD2000ES106 Programming for Problem Solving 02 Credits

Course Objective:

To develop logical skills and basic technical skills so that students should be able to solve basic computing problems. The students should be able to learn the basic of any computer programming language.

Course Outcomes:

Students will be able to:

CO1: To formulate simple algorithms for arithmetic and logical problems.

CO2: To translate the algorithms to programs (in C language).

CO3: To test and execute the programs and correct syntax and logical errors.

CO4: To implement conditional branching, iteration and recursion.

CO4: To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

CO5: To use arrays, pointers and structures to formulate algorithms and programs.

CO6: To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

CO7: To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

Detailed contents:

Unit 1: Introduction to Programming

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.

Unit 2: Arithmetic expressions and precedence, Arrays

Conditional Branching and Loops Writing and evaluation of conditionals and consequent branching Iteration and loops, Arrays (1-D, 2-D), Character arrays and Strings

Unit 3: Basic Algorithms

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 4: Function and Recursion

Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference.

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 5: Structures and Pointers

Structures, Defining structures and Array of Structures.

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation).

Text Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course	Name Instructor	Host Institute
1.	Problem Solving Through Programming In C	Prof. Anupam Basu	IIT Kharagpur

23UD2000ES106L Programming for Problem Solving Lab 01 Credit

At least 08 experiments should be performed from the following list:

1. Familiarization with programming environment
2. Simple computational problems using arithmetic expressions
3. Problems involving if-then-else structures
4. Iterative problems e.g., sum of series
5. 1D Array manipulation
6. Matrix problems, String operations

7. Simple functions
8. Programming for solving Numerical methods problems
9. Recursive functions
10. Pointers and structures
11. File operations

23UD2EGDES204	Engineering Graphics & Design	02 Credits

Course Objectives:

1. To prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
2. To prepare you to communicate effectively
3. To prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

Course Outcomes:

Students will be able to:

CO1: Introduce the engineering design and its place in society
CO2: Expose to the visual aspects of engineering design
CO3: Expose to engineering graphics standards
CO4: Expose to solid modelling
CO5: Expose to computer-aided geometric design
CO6: Expose to creating working drawings
CO7: Expose to engineering communication

Unit 1: Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain, Diagonal and Vernier Scales.

Unit 2: Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Unit 3: Computer Graphics

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling.

Unit 4: Projections

Orthographic Projections: Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes; Projections of Regular Solids: those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale.

Unit 5: Sectioning of Solids, Isometric Projections

Sectioning of solids: Section planes perpendicular to one plane and parallel or inclined to other plane. Isometric projections: Isometric scale, drawing of isometric projections from given orthographic views.

Reference/Text Books:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 46th Edition, 2003.
2. K. V. Nataraajan, A text book of Engineering Graphic, Dhanalakshmi Publishers, Chennai, 2006.
3. K. Venugopal and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd, 2008.
4. Dhananjay A. Jolhe, Engineering Drawing with an Introduction to Autocad, Mc GrawHill Education, 2017.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course	Name Instructor	Host Institute
1.	Engineering Graphics and Design	Prof. Naresh Varma Datla, Prof. S. R. Kale	IIT Delhi

23UD2EGDES205L Engineering Graphics & Design Lab 01 Credit

List of Experiments

1. Lines, lettering and dimensioning.
2. Geometrical Constructions.
3. Orthographic projections.
4. Projections of points and straight lines
5. Projections of planes.
6. Projections of solids.
7. Section of solids.
8. Isometric Projections.

23UD1372PC107	Consumer Electronics	02 Credits

Course Objectives:

1. To acquaint students with the practical knowledge of designing and developing consumer electronic systems and products and introduce the latest trends and technologies.

Course Outcomes:

Students will be able to:

CO1: List technical specification of electronics Audio system (microphone and speaker)

CO2: Trouble shoots consumer electronics products like TV, washing machine and AC.

CO3: Identify and explain working of various colour TV transmission blocks.

CO4: Adjust various controls of colour TV receiver and troubleshoot it.

CO5: Use various functions of Cam coder and shoot a video and take snapshots and save them in appropriate format

Unit 1: Communication devices

Mobile handsets, Android technology, 2G, 3G Mobiles, i-phone, EPABX

Unit 2: Mass Communication devices

Color Television, Antenna, HDTV, LCD TV,LED TV, 3D Technology In TV, Interactive TV, DTHTV, Plasma TV, Video Conferencing, FAX Machine, PA System, Dolby Digital Systems, Gesture Technology In TV.

Unit 3: Household e1cctronics devices

Washing Machine, Microwave Oven, Types Applications, Electronics Weighing Balance, Air Conditioner, Vacuum Cleaner.

Unit 4: Compliance

Product safety and liability issues, standards related to electrical safety and standards related to fire hazards, e.g., UL and VDE. EM1/EMC requirements and design techniques for compliance, e.g. ESD, RF interference and immunity, line current harmonics and mains voltage surge.

Text Books/References:

1. Television &Video Engineering-A. M. Dhake, TMH Publication.
2. Monochrome and Color TV - R. R. Gulati, Wiley Eastern publication.
3. Video demystified -Keith Jack, PI publication
4. Audio &Video Systems-R.G.Gupta
5. Audio and Video system - Principles, maintenance and Troubleshooting by R. Gupta
6. Arora C. P., "Refrigeration and Air conditioning", Tata McGraw-Hill, New Delhi, 1994
7. Color TV Theory &Practice -S. P. Bali. TMG Hill Publication.
8. Basic TV &Video Systems-Bernard Grobb.

9. Electronic Communication Systems, Kennedy, TMH.
10. Principles of Communication Engineering- Anokh Singh-TMH.
11. M. Wintzer, International Commercial EMC Standards, Interference Control Techno1ologies 1988.
12. P. A. Chatterton and M. A. Houlden, EMC: Electromagnetic Theory to Practical Design. Wiley, 1992.
13. J. A. S. Angus, Electronic Product Design, Chapman and Hall, 1996.
14. Y. J. Wind, Product Policy: Concepts, Methods, and Strategy, Addison-Wesley Pub. Co. 1982.

23UD2000VS108	Communication Skills	02 Credits

Course Objectives:

1. To provide learning environment to practice listening, speaking, reading and writing skills.
2. To assist the students to carry on the tasks and activities through guided instructions and materials.
3. To effectively integrate English language learning with employability skills and training.
4. To provide hands-on experience through case-studies, mini-projects, group and individual presentations.

Course Outcome:

Students will be able to:

CO1: The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Unit 1: Vocabulary Building

1.1. The concept of Word Formation
1.2. Root words from foreign languages and their use in English
1.3. Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4. Synonyms, antonyms, and standard abbreviations.

Unit 2: Basic Writing Skills

1.1. Sentence Structures
1.2. Use of phrases and clauses in sentences
1.3. Importance of proper punctuation
1.4. Creating coherence
1.5. Organizing principles of paragraphs in documents
1.6. Techniques for writing precisely

Unit 3: Identifying Common Errors in Writing

1.1. Subject-verb agreement
1.2. Noun-pronoun agreement
1.3. Misplaced modifiers
1.4. Articles

1.5. Prepositions
1.6. Redundancies
1.7. Clichés

Unit 4: Nature and Style of sensible Writing
1.1. Describing
1.2. Defining
1.3. Classifying
1.4. Providing examples or evidence
1.5. Writing introduction and conclusion

Unit 5: Writing Practices
1.1. Comprehension
1.2. Précis Writing
1.3. Essay Writing

Unit 6: Oral Communication
(This Module involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Text/Reference Books:

1. AICTE's Prescribed Textbook: English (with Lab Manual) ISBN: 978-93-91505-097
2. Effective Communication Skills. Kul Bhushan Kumar, Khanna Book Publishing, 2022.
3. Practical English Usage. Michael Swan. OUP. 1995.
4. Remedial English Grammar. F.T. Wood. Macmillan.2007
5. On Writing Well. William Zinsser. Harper Resource Book. 2001
6. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
7. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
8. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	English Language for Competitive Exams	Prof. Aysha Iqbal	IIT Madras

2	Technical English for Engineers	Prof. Aysha Iqbal	IIT Madras

23UD2000VS108L	Communication Skill Lab	01 Credit

List of Practicals:

1. How to introduce oneself ? (02 hrs)
2. Know your friend (02 hrs)
3. Introduction to Phonemic symbols (02 hrs)
4. Articulation of sounds in English with proper manner (02 hrs)
5. Practice and exercises on articulation of sounds (02 hrs)
6. Read Pronunciations/transcriptions from the dictionary (02 hrs)
7. Practice and exercises on pronunciations of words (02 hrs)
8. Introduction to stress and intonation (02 hrs)
9. Rapid reading sessions (02 hrs)
10. Extempore (02 hrs)
11. Group discussion (02 hrs)
12. Participating in a debate (02 hrs)
13. Presentation techniques (02 hrs)
14. Interview techniques (02 hrs)

23UD2000CC109A	NSS-II	02 Credits

Unit 1: Life Competencies and skill

Definition and importance of life competencies, Communication, Inter Personal, Problem solving and decision making, Positive thinking, Self-confidence and self-esteem, Life goals, Stress and time management

Unit 2: Social Harmony and National Integration

Indian history and culture, Role of youth in peace-building and conflict resolution, Role of youth in Nation building

Unit 3: Youth Development Programmes in India

National Youth Policy, Youth development programmes at the National Level, State Level and voluntary sector, Youth-focused and Youth-led organizations

23UD2000CC109B	Health and Wellness	02 Credits

Course Objectives:

1. To systematically addresses the issues of health, adjustment and well-being.
2. To provide insights from the field of psychology to make your life more satisfying and meaningful.

Course Outcomes:

Students will be able to:

CO1: Learn how to deal with mental distress and disorders

CO2: Understand and enhance positive mental health and wellbeing particularly in the field of psychology.

CO3: Gain happiness and well-being theory and research to enrich the understanding of both negative and positive side of human behaviour.

Unit 1: Psychology of happiness

What is happiness? What makes us happy? Socio-economic factors and happiness; Positive emotions

Unit 2: Can we become happier?

Genetic set-point and hedonic adaptation; Sustainable happiness model and intentional activities

Unit 3: Happiness Activities 1

Expressing gratitude and positive thinking; Love and kindness; Avoiding overthinking and social comparison

Unit 4: Happiness Activities 2

Identifying signature strengths; achieving happiness with "Flow".

Unit 5: Is happiness sufficient?

The concept of eudaimonic well-being; Self-determination and motivation

Reference:

1. W. Weiten, and M. A. Lloyd, Psychology Applied to Modern Life: Adjustment in the 21st Century, Wadsworth Publishing, 2007
2. R. Harington, Stress, Health and well-being: Thriving in the 21st century, Wadsworth Publishing, 2013.
3. I. Boniwell, Positive psychology in a nutshell, McGraw-Hill Education, 2012.
4. S. Lyubomirsky, The how of happiness, Penguine Press, 2008.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Psychology of Stress, Health and Well-being	Prof. Dilwar Hussain	IIT Guwahati

23UD2000CC109C	Study from Still Life	02 Credits

Course Objective:

1. The students should be able to develop potential for creativity, self-expression and visual awareness through painting.
2. The students should be able feel confident with the chosen medium as a means of communicating and generating ideas.
3. They should develop observation, recording, manipulation, application skills and understand the basic principles of colour.

Course Outcomes:

Students will be able to:

CO1: Understand the objects shape and form.

CO2: Understand the principle of still life, dimension with tone, texture etc.

CO3: Understand the elements of still life composition and principle of natural and man-made objects etc.

CO4: Develop potential for creativity, self-expression and visual awareness through painting.

Detailed contents:

Unit 1:

Introduction of Course & Still Life, Elements of Art.

Unit 2:

Sketching and Drawing, Geometrical Form & Shape, Symmetrical and Non-symmetrical object sketching.

Unit 3:

Use of Line, Tone & Shading, Single Symmetrical & Non-symmetrical Object still life.

Unit 4:

Nature study with Objects, Vegetable Study with Objects.

Unit 5:

Objects study with Drapery, Group Objects & Nature Study, Object study with Oil colour.

Reference:

1. NPTEL/SWAYAM Course:

S. No.	NPTEL Course	Name Instructor	Host Institute
1.	Study from Still Life	Dr. Lakshaman Prasad	Indira Gandhi National Open University

23UD2000CC109D	Hindustani Music	02 Credits

Course Objectives:

1. To appreciate the diversity and uniqueness in Hindustani Music

Course Outcomes:

Students will be able to:

CO1: Learn three vibrant genres of Dhrupad, Khayal and Instrumental Music which this course explores with a focus on Khayal.

CO2: Do contemporary practice while also drawing upon historical and textual scholarship to place the music in perspective.

CO3: Get benefits from highly regarded musicians, musicologists and scholars and guided listening of recorded music.

Unit 1: Hindustani Music

A World of Colour, Romance, and History,
Classical or Shastriya – What's in a Name!
Dhrupad, Khayal and Instrumental Music – A Bird's-eye View.
Hindustani Music as Raga Sangeet,
The Textual Tradition,
Swara and Shruti: Tone and Microtone,
Swara and Shruti in the Textual Tradition,
Tanpura – The King of Overtones,
Entering the World of Raga – Raga and Swara,
The World of Raga – 2: Strong and Weak Notes,
The World of Raga – 3: Ornament,
The World of Raga – 4: Paths of a Raga,
Raga and Time Association

Unit 2: Raga Lakshana or Features of Raga

Defining Raga,
Classification of Ragas – the Mela or Thaat System,
Classification of Ragas – the Raagaanga System,
Classification of Ragas – the Raga Ragini system.
Extending the Raga Corpus – Winds from the South,
Extending the Raga Corpus– Jod Ragas,
Principles of Time in Hindustani Music – Tala and Laya,
Some Aspects of Tala and a Few Important Tala-s, Tabla as Keeper of Tala in Khayal, Khayal-A Compositional Form, Some Contemporary Composers of Khayal.

Unit 3: The Vilambit Khayal Improvisation in Khayal

Elements of Raga Vistaar., The Eight Limbs or Ashtaanga of Khayal and the nature of Tabla accompaniment., A Typical Khayal Presentation, Raga Profiles as Captured in Bandish
Gharanas of Hindustani Music – Introduction
Gharanas of Hindustani Music – Early Masters
Gharanas of Hindustani Music – Twentieth Century masters
Gharanas of Hindustani Music – Melodic accompaniment in Khayal

The Harmonium as a solo and accompanying instrument.

Unit 4: Dhrupad

Style and structure, alaap, compositional forms, song texts:The Enchanting World of Thumri
Instrumental Music – an Introduction
The Sarod: A Lecture demonstration by Pt Suresh Vyas
The Sitar: A Lecture demonstration by Dr Supriya Shah

Reference:

1. **NPTEL/SWAYAM Course:**

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Hindustani Music	Prof. Lakshmi Sreeram, Prof. Srijan Deshpande	IIT Madras, Manipal Academy of Higher Education, Manipal