Rayat Shikshan Sanstha's

Karmaveer Bhaurao Patil, College of Engineering, Satara.

An Autonomous Institute & Affiliated to DBATU Lonere

Accredited by NAAC with "B++" Grade

First Year B. Tech

Basic Sciences & Humanities

Structure & Curriculum

(w.e.f. A.Y. 2026-27)

As Per NEP 2020

NCrF Level 6

Recommended in BOS (BSH) Meeting Dated: 11th June 2026

&

Approved in Academic Council Meeting Dated: 20th July 2026

S. R. Ballal	Smodi	
Dr. S. R.Ballal	**Dr. S. J. Modi**	**Dr. A. C. Attar**
BOS Chairman (BSH)	**Member Secretary**	**Principal**
	Academic Council	

Rayat Shikshan Sanstha's

KARMAVEER BHAURAO PATIL COLLEGE OF ENGINEERING, SATARA

An Autonomous Institute and Affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere

Accredited by NAAC & NBA

DEPARTMENT OF BASIC SCIENCES & HUMANITIES

STRUCTURE AND CURRICULUM

(w.e.f. Academic Year 2026 - 2027)

As per NEP 2020

Key Features of Curriculum

Multiple entry and exit option after every year.

1. Provision for Open Electives (OE), Vocational and Skill Enhancement Courses (VSE), Ability Enhancement Courses (AE), Indian Knowledge System (IKS), Value Education Courses (VE), Co-Curricular Courses (CC) in addition to program core courses.
2. Mandatory internship of one semester.
3. Credits for Value education courses, Ability Enhancement Courses, Co-Curricular Curricular activities.
4. Mandatory Non-Credit Courses.
5. Interdisciplinary and multidisciplinary education through single and double minors and open electives.
6. Skill based courses and multiple exit level.
7. Provision for learning in online mode through Swayam / NPTEL etc courses
8. Provision for B.Tech. Honours with Research degree through research project.
9. Opportunity for learner to choose courses of their interest in all disciplines.
10. Provision of Skill Based Courses and internship/Field project/mini projects for exit options at each level.
11. Flexibility for all types of learners

Degree	Total Credits
Four year Bachelor of Technology (B.E./B.Tech. or Equivalent) in Engineering/Technology with Multidisciplinary Minor	Proposed Total Credits: 172
AND	
Four Year Bachelor's Degree (B.E./B.Tech. or Equivalent) in Engineering/Technology – Honors and Multidisciplinary Minor	18–20 additional credits over and above the credit requirement of the regular B.Tech. Degree. Total 192-194 Credits
OR	
Four Year Bachelor's Degree (B.E./B.Tech. or Equivalent) in Engineering/Technology – Honors with Research and Multidisciplinary Minor	
OR	
Four Year Bachelor's Degree (B.E./B.Tech. or Equivalent) in Engineering/Technology – Major Engineering Discipline with Double Minors (Multidisciplinary Minor and Specialization Minor)	

Curriculum Framework

List of Abbreviations

Sr. No.	Abbreviation	Type of Course
1	BSC	Basic Science Course
2	ESC	Engineering Science Course
3	PCC	Programme Core Course
4	VSEC	Vocational and Skill Enhancement Course
5	AEC	Ability Enhancement Course
6	IKS	Indian Knowledge System
7	CC	Co-Curricular Courses

Credit Distribution for each year and Exit Option

NCrF Level	Year/ Sem	Exit Option	Minimum Credit Requirements	Maximum Credit Requirements	Credits	Additional Credits for exit students	Total Credits
4.5	I & II	U. G. Certificate	40	44	42	8	**50**
5	III &IV	U. G. Diploma	80	88	86	8	**94**
5.5	V & VI	B. Vocational / B.Sc.	120	132	130	8	**138**
6	VII & VIII	B. Tech. Major with Multidisciplinary Minor	160	176	172	-	**172**
6	VII & VIII	B.Tech. Honors and Multidisciplinary Minor	180	194	172	18	**190**
		B.Tech. Honors with Research and Multidisciplinary Minor	180	194	172	18	**190**
		B.Tech. with Double Minor (Multidisciplinary and Specialization Minor)	180	194	172	18	**190**

Semester-Wise Credit Distribution

SEM-I Group A		
Course Category	As per NEP GR	Credits
BSC	6-8	7
ESC	8-10	8
PCC	-	-
VSEC	2	2
AEC	2	3
IKS	-	-
CC	2	1
Total Credits	20-22	21

SEM-II Group A		
Course Category	As per NEP GR	Credits
BSC	8-10	7
ESC	6-4	7
PCC	2	2
VSEC	2	2
AEC	-	-
IKS	2	2
CC	2	1
Total Credits	20-22	21

SEM-I Group B		
Course Category	As per NEP GR	Credits
BSC	8-10	7
ESC	6-4	7
PCC	2	2
VSEC	2	2
AEC	-	-
IKS	2	2
CC	2	1
Total Credits	20-22	21

SEM-II Group B		
Course Category	As per NEP GR	Credits
BSC	6-8	7
ESC	8-10	8
PCC	-	-
VSEC	2	2
AEC	2	3
IKS	-	-
CC	2	1
Total Credits	20-22	21

Credit Norms (as per UGC/AICTE Practices)

Activity	Credit Norm
1 Hour Theory / Week	1 Credit
2 Hours Laboratory / Week	1 Credit
1 Hour Tutorial / Week	1 Credit

Evaluation Scheme

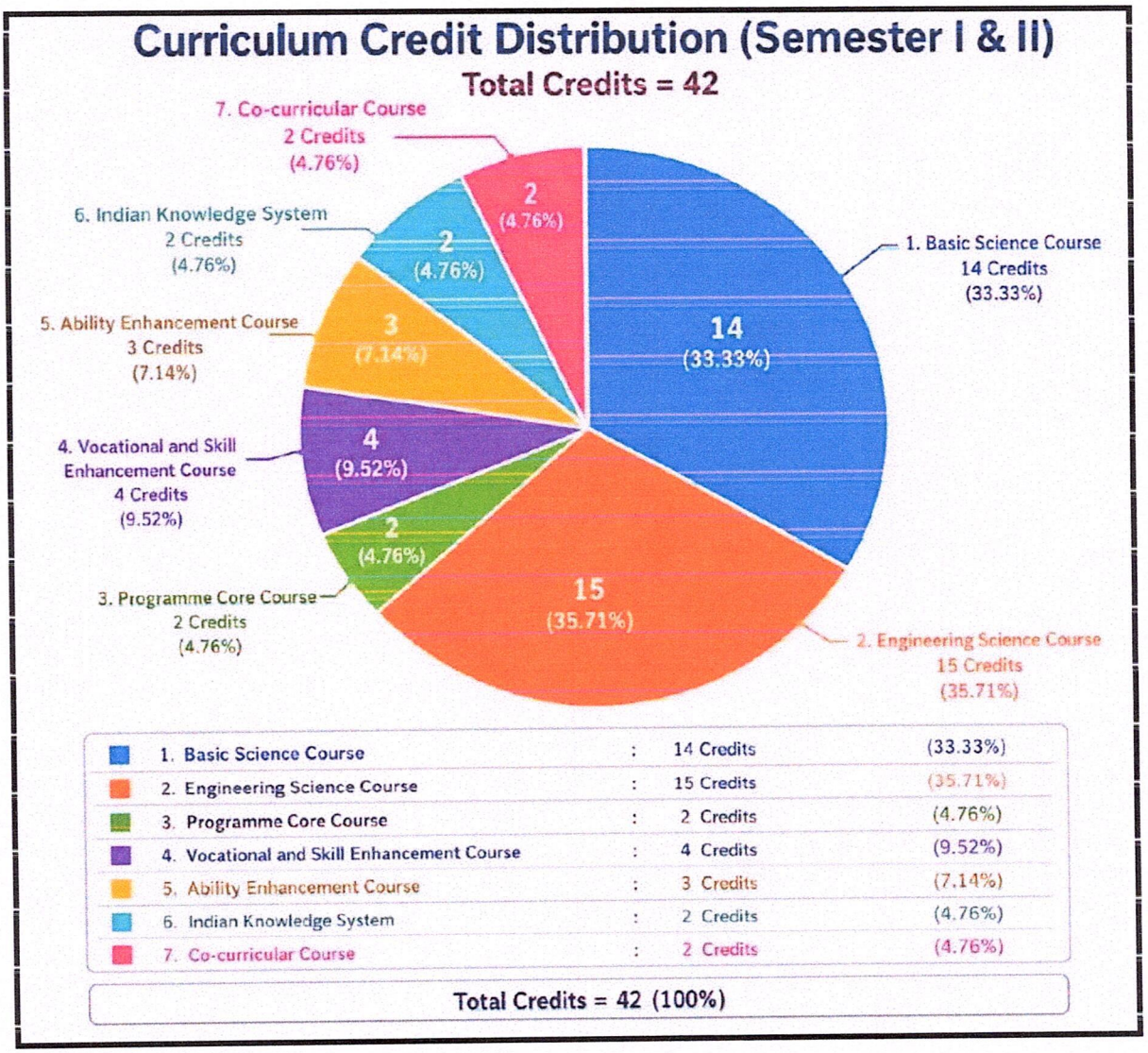
For Theory Courses

Component	Weightage
Continuous Assessment	10%
Mid Semester Examination	30%
End Semester Examination	60%

For Laboratory Courses

Component	Weightage
Continuous Assessment	60%
End Semester Examination	40%

Credit Distribution Chart



Semester-Wise Credit Distribution

Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits
BSC/ESC	Basic Science Course	7	7	-	-	-	-	-	-	14
	Engineering Science Course	8	7	-	-	-	-	-	-	15
Program Courses	Programme Core Course (PCC)	-	2	-	-	-	-	-	-	2
	Programme Elective Course (PEC)	-	-	-	-	-	-	-	-	-
Multidisciplinary Courses	Multidisciplinary Minor (MDM)	-	-	-	-	-	-	-	-	-
	Open Elective (OE) Other than a particular program	-	-	-	-	-	-	-	-	-
Skill Courses	Vocational and Skill Enhancement Course (VSEC)	2	2	-	-	-	-	-	-	4
Humanities Social Science and Management (HSSM)	Ability Enhancement Course (AEC -01, AEC-02)	3	-	-	-	-	-	-	-	3
	Entrepreneurship / Economics/ Management Courses	-	-	-	-	-	-	-	-	-
	Indian Knowledge System (IKS)	-	2	-	-	-	-	-	-	2
	Value Education Course (VEC)	-	-	-	-	-	-	-	-	-
Experientiai Learning Courses	Research Methodology	-	-	-	-	-	-	-	-	-
	Comm. Engg. Project (CEP)/Field Project (FP)	-	-	-	-	-	-	-	-	-
	Project	-		-	-	-	-	-	-	-
	Internship/ OJT	-	-	-	-	-	-	-	-	-
Liberal Learning Courses	Co-curricular Courses (CC)	1	1	-	-	-	-	-	-	2
Total Credits (Major)		21	21							42

Semester-wise Basket Themes for Emerging Technology Specialization

Bucket	Course	Course Code	Suggested Theme Name
Bucket	Indian Knowledge System (IKS)	26BSHA209A / 26BSHB109A	1. Indian Knowledge System In Architecture And Town Planning
		26BSHA209B / 26BSHB109B	2.Indian Ethics
		26BSHA209C / 26BSHB109C	3.Indian Astronomy

General Instructions

- In the eighth semester, students must complete a mandatory internship for one semester at a company or organization approved by the BOS Chairman.
- During the eighth-semester internship, students must complete theory courses through one of the two modes:
- Online mode, where courses are offered through SWAYAM/NPTEL or an equivalent platform, providing an evaluation mechanism approved by the BOS Chairman. In this case:
- Students can register and complete these online courses any time after the beginning of the third semester.
- The course must be completed and the scorecard/certificate submitted before the declaration of the eighth-semester result.
- If a student fails an online course, they must register for the same course offered by the institute and appear for ESE examination of 100 marks only personally as per the schedule declared by the institute to successfully complete the course.
- Self-study mode, where students study independently using the course offered by the institute.
- Students must appear for all college assessments/examinations (ISE, MSE, ESE) personally as per the institute's schedule and successfully complete the course.
- In addition to program-specific courses, students must complete vocational skill courses, internships, and field projects connected to their major degree.

Exit Options:

- The exit option is available at the end of even semesters (2nd, 4th, and 6th semesters), commencing from the academic year 2027-28 for the UG Certificate.
- Students opting for exit at any level (odd or even semesters) must earn an additional eight credits in skill-based vocational courses, internships, apprenticeships, or mini-projects before exiting.
- This makes them eligible for a UG Certificate, UG Diploma, or B.Voc./B.Sc. Engineering degree, depending on their qualification level.

Re-entry and Lateral Entry:

- Students opting for exit after an even semester may re-enter within four years and resume from the next odd semester they left off.
- There must be a gap of at least one year between exit and re-entry.
- Students opting for exit after an odd semester (1st, 3rd, 5th, or 7th) may only re-enter the program during the next even semester.
- There must be a gap of at least one year between exit and re-entry.

Maximum Duration for Degree Completion:

- The B.Tech degree must be completed within eight years from the date of admission to the first-year undergraduate program.
- The duration includes exit, withdrawal, absence, or permissible leaves but excludes rustication periods.
- If exceptional cases arise, valid reasons may be presented to the Academic Council, which may approve an extension of one additional year.
- Eligibility for Admission to UG Bachelor's Degree with Honors, Research, or Double Minor:
- Students must have a minimum CGPA of 7.5 with no backlogs at the end of the second semester and must have earned 18 credits.

Multiple Exit Qualification Titles & Requirements:

- Exit-1 (NCrF Level 4.5) – One-Year UG Certificate in Engineering/Technology (Requires 8 additional credits by 2-Month internship /Technical Project/Industrial Training or equivalent skill courses).
- Exit-2 (NCrF Level 5.0) – Two-Year UG Diploma in Engineering/Technology (Requires 8 additional credits by 2-Month internship /Technical Project/Industrial Training or equivalent skill courses).
- Exit-3 (NCrF Level 5.5) – Three-Year B.Voc/B.Sc. Engineering Degree (Requires 8 additional credits by 2-Month internship /Technical Project/Industrial Training or equivalent skill courses).

Multiple Exit Options

Option	NCrF Level	Qualification Title	Additional Credit Requirement	Bridge Courses
Exit-1	4.5	One-Year UG Certificate Course in Engineering / Technology	8	2 Months Internship / Technical Project/Industrial Training OR Online Two Skill Courses from NSQF/ESSC/Any Other Agency certification approved by BoS
Exit-2	5.0	Two-Year UG Diploma in Engineering/Technology	8	2 Months Internship / Technical Project/Industrial Training OR Online Two Skill Courses at Diploma Level from NSQF/ESSC/Any Other Agency certification approved by BoS
Exit-3	5.5	Three-Year Bachelor Degree in Vocation (B.Voc.) or B.Sc. (Engineering/Technology)	8	2 Months Internship / Technical Project/Industrial Training OR Online Two Skill Courses at Degree Level from NSQF/ESSC/Any Other Agency certification approved by BoS

Curriculum Structure

of

First Year B.Tech.[Common to All]

Effective from

Academic Year 2026-27

First Year B. Tech. Common to All
(W.E.F. 2026-27)
Group A SEMESTER -I

Sr. No	Course Category	Course Code	Course Name	Teaching Scheme (Weekly Hour)				Cr	Evaluation Scheme (Weightage in Marks)			
				L	T	P	S		ISE	MSE	ESE/ POE	Total
1	Basic Science Course (BSC)	26BSH101	Engineering Mathematics – I	3	-	-	1	3	10	30	60	100
2	Basic Science Course (BSC)	26BSHA102	Engineering Chemistry	3	-	-	1	3	10	30	60	100
3	Engineering Science Course (ESC)	26BSHA103	Engineering Mechanics	3	-	-	1	3	10	30	60	100
4	Engineering Science Course(ESC)	26BSHA104	Basic Mechanical Engineering	2	-	-	1	2	10	30	60	100
5	Ability Enhancement Course (AEC-01)	26BSHA105	Communication Skills	2	-	-	1	2	10	30	60	100
6	Basic Science Course BSC	26BSHA106	Engineering Chemistry Lab	-	-	2	-	1	60	-	40	100
7	Engineering Science Course (ESC)	26BSHA107	Engineering Mechanics Lab	-	-	2	-	1	60	-	40	100
8	Engineering Science Course (ESC)	26BSHA108	Python Programming Lab	-	-	4	-	2	60	-	40	100
9	Vocational and Skill Enhancement Course (VSEC)	26BSHA109	Workshop Practices-I	-	-	4	-	2	60	-	40	100
10	Ability Enhancement Course (AEC-01)	26BSHA110	Communication Skills Lab	-	-	2	-	1	60	-	40	100
11	Co-curricular Courses (CC)	26BSHA111A	Sports &Physical Education	-	-	2	-	1	60	-	40	100
		26BSHA111B	Music & Dance									
		26BSHA111C	Yoga Education									
			Total	13	-	16	5	21	410	150	540	1100

Legends: L-Lecture, T-Tutorial, P-Practical, Cr-Credits S-Self Study

Total Contact Hours/Week: 29 **-Cumulative Credits:21+21=42**
ISE: In Semester Evaluation **-ESE: End Semester Examination**

First Year B. Tech. Common to All
(W.E.F. 2026-27)
Group A SEMESTER -II

Sr. No	Course Category	Course Code	Course Name	Teaching Scheme (Weekly Hour)				Cr	Evaluation Scheme (Weightage in Marks)			
				L	T	P	S		ISE	MSE	ESE/ POE	Total
1	Basic Science Course (BSC)	26BSH201	Engineering Mathematics – II	3	-	-	1	3	10	30	60	100
2	Basic Science Course (BSC)	26BSHA202	Engineering Physics	3	-	-	1	3	10	30	60	100
3	Engineering Science Course (ESC)	26BSHA203	Engineering Graphics	3	-	-	1	3	10	30	60	100
4	Engineering Science Course(ESC)	26BSHA204	Basic Civil Engineering	2	-	-	1	2	10	30	60	100
5	Basic Science Course (BSC))	26BSHA205	Engineering Physics Lab	-	-	2	-	1	60	-	40	100
6	Engineering Science Course(ESC)	26BSHA206	Engineering Graphics Lab	-	-	4	-	2	60	-	40	100
7	Programme Core Course (PCC)	26BSHA207	Basics in AI-I-RA Lab	-	-	4	-	2	60	-	40	100
8	Vocational and Skill Enhancement Course (VSEC)	26BSHA208	Design Thinking			4		2	60	-	40	100
9	Indian Knowledge System (IKS)	26BSHA209	IKS Bucket #	2	-	0	-	2	60	-	40	100
10	Co-curricular Courses (CC)	26BSHA210A	Integrated Personality Development	-	-	2	-	1	60	-	40	100
		26BSHA210B	Health and Wellness									
		26BSHA210C	Social Outreach Activities									
				13	-	16	4	21	400	120	480	1000

Legends: L-Lecture, T-Tutorial, P-Practical, Cr-Credits S-Self Study

Total Contact Hours/Week: 29 **-Cumulative Credits:21+21=42**
ISE: In Semester Evaluation **-ESE: End Semester Examination**

First Year B. Tech. Common to All
(W.E.F. 2026-27)
Group B SEMESTER -I

Sr. No	Course Category	Course Code	Course Name	Teaching Scheme (Weekly Hour)				Cr	Evaluation Scheme (Weightage in Marks)			
				L	T	P	S		ISE	MSE	ESE/ POE	Total
1	Basic Science Course (BSC)	26BSH101	Engineering Mathematics – I	3	-	-	1	3	10	30	60	100
2	Basic Science Course (BSC)	26BSHB102	Engineering Physics	3	-	-	1	3	10	30	60	100
3	Engineering Science Course (ESC)	26BSHB103	Engineering Graphics	3	-	-	1	3	10	30	60	100
4	Engineering Science Course(ESC)	26BSHB104	Basic Civil Engineering	2	-	-	1	2	10	30	60	100
5	Basic Science Course (BSC))	26BSHB105	Engineering Physics Lab	-	-	2	-	1	60	-	40	100
6	Engineering Science Course(ESC)	26BSHB106	Engineering Graphics Lab	-	-	4	-	2	60	-	40	100
7	Programme Core Course (PCC)	26BSHB107	Basics in AI-I-RA Lab	-	-	4	-	2	60	-	40	100
8	Vocational and Skill Enhancement Course (VSEC)	26BSHB108	Design Thinking	-	-	4	-	2	60	-	40	100
9	Indian Knowledge System (IKS)	26BSHB109	IKS Bucket #	2	-	0	-	2	60	-	40	100
10	Co-curricular Courses (CC)	26BSHB110A	Integrated Personality Development	-	-	2	-	1	60	-	40	100
		26BSHB110B	Health and Wellness									
		26BSHB110C	Social Outreach Activities									
				13	-	16	4	21	400	120	480	1000

Legends: **L**-Lecture, **T**-Tutorial, **P**-Practical, **Cr**-Credits **S**-Self Study

Total Contact Hours/Week: 29 **-Cumulative Credits:21+21=42**
ISE: In Semester Evaluation **-ESE: End Semester Examination**

Rayat Shikshan Sanstha's

Karmaveer Bhaurao Patil College of Engineering, Satara

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Affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere - from 2017

First Year B. Tech. Common to All
(W.E.F. 2026-27)
Group B SEMESTER -II

Sr. No	Course Category	Course Code	Course Name	Teaching Scheme (Weekly Hour)				Cr	Evaluation Scheme (Weightage in Marks)			
				L	T	P	S		ISE	MSE	ESE/ POE	Total
1	Basic Science Course (BSC)	26BSH201	Engineering Mathematics – II	3	-	-	1	3	10	30	60	100
2	Basic Science Course (BSC)	26BSHB202	Engineering Chemistry	3	-	-	1	3	10	30	60	100
3	Engineering Science Course (ESC)	26BSHB203	Engineering Mechanics	3	-	-	1	3	10	30	60	100
4	Engineering Science Course(ESC)	26BSHB204	Basic Mechanical Engineering	2	-	-	1	2	10	30	60	100
5	Ability Enhancement Course(AEC-01)	26BSHB205	Communication Skills	2	-	-	1	2	10	30	60	100
6	Basic Science Course BSC	26BSHB206	Engineering Chemistry Lab	-	-	2	-	1	60	-	40	100
7	Engineering Science Course (ESC)	26BSHB207	Engineering Mechanics Lab	-	-	2	-	1	60	-	40	100
8	Engineering Science Course (ESC)	26BSHB208	Python Programming Lab	-	-	4	-	2	60	-	40	100
9	Vocational and Skill Enhancement Course (VSEC)	26BSHB209	Workshop Practices-I	-	-	4	-	2	60	-	40	100
10	Ability Enhancement Course(AEC-01)	26BSHB210	Communication Skills Lab	-	-	2	-	1	60	-	40	100
11	Co-curricular Courses (CC)	26BSHB211A	Sports &Physical Education	-	-	2	-	1	60	-	40	100
		26BSHB211B	Music & Dance									
		26BSHB211C	Yoga Education									
			Total	13	-	16	5	21	410	150	540	1100

Legends: L-Lecture, T-Tutorial, P-Practical, Cr-Credits S-Self Study

Total Contact Hours/Week: 29 -Cumulative Credits:21+21=42

ISE: In Semester Evaluation -ESE: End Semester Examination

UG Certificate Level

Exit Course after Semester -II of Engineering

(UG Certificate Course in Engineering /Technology

Course Category	Course Code	Name of Course	Weekly Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	ISE	MSE	ESE	Total	
Exit	BSHEX01	Computer Hardware Basics Skill India Digital Hub (SIDH) - Upskilling, reskilling, career growth and lifelong learning				120	00	80	200	8
	OR									
	BSHEX01	Industrial Training for 2 Month				120	00	80	200	8
Total Contact Hrs. : 48 to 64										08

Rayat Shikshan Sanstha's
Karmaveer Bhaurao Patil College of Engineering, Satara
An Autonomous Institute

Department of Basic Sciences & Humanities Engineering

Course: F. Y.	Semester: I	L	T	P	Credits
Course Code: 26BSH101	Course Name: Engineering Mathematics I	3	-	-	3

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

CO1	Examine consistency and non-consistency of homogeneous and non-homogeneous systems of linear equations using matrix methods and determine rank of matrix
CO2	Apply properties of Eigen values and Eigen vectors to solve Cayley Hamilton's theorem
CO3	Apply properties of complex numbers and complex functions to solve Mathematical and engineering problems.
CO4	Apply vector differential operators and vector integral calculus to solve mathematical and engineering problems.
CO5	Select appropriate method to find numerical solutions of first-order differential equations using standard numerical techniques
CO6	Expand periodic functions into Fourier series and determine half-range sine and cosine series representations

Prerequisites: Basics of Mathematics

Unit No.	Description	Hrs.
1	**Matrices & Linear System Equation**: 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	7
2	**Eigen values and Eigen vectors** : Properties of eigen values and eigen vectors (Without proofs); Cayley Hamilton's theorem (without proof) and its applications to find higher power of matrix.	6
3	**Complex Nos** :Definition and geometrical representation ; De-movie's theorem (without proof) ; Roots of complex numbers by using De-movie'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	7
4	**Vector calculus** : Scalar and vector fields ; Gradient ,divergence and curl ; solenoidal and irrotational vector fields ;vector identities (statements without proof) ;Green's Lemma ,Stroke's theorem	6

5	**Numerical Solutions of Ordinary Differential Equations**–Introduction, Taylor series Method, Euler's Method, Modified Euler's Method, Runge kutta Method of Fourth Order	6
6	**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-range series.	7

Text Books: 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. Linear Algebra (3rd edition) by Serge Lang, Springer.
3. Linear Algebra and its applications (4th edition) by Gilbert Strang, Cengage Learnings (RS).
4. Elementary Linear Algebra (10th edition) by Howard Anton and Chris Rorres, John Wiley,and sons.
5. A Course in Engineering Mathematics (Vol I) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai

CO-PO Matrix

Course Outcome	Programme Outcome (PO)/ Programme Specific Outcome(PSO)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2
CO1	3	2	-	-	-	-	1	1	-	-	1	-	-
CO2	3	2	-	-	-	-	1	1	-	-	1	-	-
CO3	3	2	-	-	-	-	1	1	-	-	1	-	-
CO4	3	2	-	-	-	-	1	1	-	-	1	-	-
CO5	3	2	-	-	-	-	1	1	-	-	1	-	-
CO6	3	2	-	-	-	-	1	1	-	-	1	-	-

Rayat Shikshan Sanstha's
Karmaveer Bhaurao Patil College of Engineering, Satara
An Autonomous Institute

Department of Basic Sciences & Humanities

Course: F. Y.	Semester: I / II	L	T	P	Credits
Course Code:26BSHA102/ 26BSHB202	Course Name: Engineering Chemistry	3	-	-	3

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

CO1	Evaluate the properties and calorific values of fuels, understand petroleum refining, and determine the calorific value using Bomb and Boy's calorimeters.
CO2	Classify lubricants & explain their characteristics, mechanisms, and select appropriate materials for engineering applications.
CO3	Interpret the principles, working, and analytical applications of pH-metry, thin layer chromatography, and flame photometry.
CO4	Compare and assess engineering materials such as alloys, polymers, plastics, and rubber, and recommend suitable materials for various engineering applications based on their properties and characteristics.
CO5	Describe the causes and mechanisms of corrosion and recommend suitable corrosion prevention techniques for engineering structures and equipment.
CO6	Analyze water hardness and design suitable domestic and industrial water treatment strategies, including numerical calculations related to hardness

Prerequisites: Basic understanding of Chemistry, Familiarity with fundamental concepts such as chemical reactions, acids and bases, solutions and simple numerical calculations.

Unit No.	Description	Hrs.
1	**Fuel and Energy conversion Devices** **A)** Introduction, Classification, Calorific value, definition, units (Calorie, Kcal, BTU, CHU), types of calorific value (Higher & lower), characteristics of good fuel, Determination of calorific value of fuels by Bomb and Boy's calorimeters & its numerical **B)** Alternative fuels: Power alcohol and biodiesel. Hydrogen Oxygen H2-O2 Fuel Cell, Lithium Ion Battery-construction, working, advantages, applications.	6
2	**Lubricants:** Introduction, classification, types of lubricants (solid, semisolid and liquid), Lubrication: mechanism of lubrication (fluid film, boundary and extreme pressure lubrication), characteristics of lubricants: viscosity, viscosity index, cloud and pour point, flash and fire point, Application of Lubricants, **Biodegradable Lubricants.**	6
3	**Instrumental Methods of Chemical Analysis** **A) pH-metry:** Introduction, glass electrode, principle, construction and working, advantages and disadvantages **B) Chromatography:** Introduction, Classification, Thin layer chromatography (TLC) **C) Flame Photometry:** Introduction, Principle, working and application.	6

4	**Engineering Materials** **A) Alloy:** Introduction, purposes of making alloys, classification of alloys, Composition, properties and applications of- Ferrous alloys: Plain carbon steels- (mild, medium and high), stainless steel, Nonferrous alloys: Copper alloy (Brass), Aluminium alloy (Duralumin and Alnico) **B) Polymers:** Introduction, polymers and polymerization (addition & condensation), 1.Plastics: Introduction, definition, types (thermo softening and thermosetting).Preparation,properties and uses of plastic polythene 2.Biodegradable polymers-Preparation, properties and uses Polylactic Acid	7
5	**Corrosion and its prevention** Introduction, corrosion and its causes, classification (atmospheric corrosion & electrochemical corrosion), mechanism of electrochemical corrosion (hydrogen evolution and oxygen absorption), galvanic series, factors influencing corrosion, Prevention of corrosion: by proper design and material selection, cathodic protection (Sacrificial anode method).	7
6	**Water Treatment:** Introduction, Hardness: Types of waters, Types of hardness, Calculation of hardness, Ill effects of hard water in various domestic, industries and boilers, Methods of treatments of hard water for domestic purposes by Screening, Aeration, Sedimentation, Coagulation and Sterilization (chlorination), Treatment of water for industrial purpose by hot lime soda method, Ion exchange process and Reverse Osmosis process, Numerical based on calculation of temporary and permanent hardness.	7

Text Books:

1. S. S. Dara,- "A textbook of Engineering Chemistry", S. Chand & Co., Delhi.
2. M. M. Uppal ,- "A text book of Engineering Chemistry", Khanna Publishers, New Delhi.
3. Shashi Chawla, - "A text book of Engineering Chemistry", Dhanpatrai & Co.

Reference Books:

1. Chatwal, Anand,- "Instrumental methods of chemical analysis", Himalaya publishing house.
2. Dr. A. K. Phari and B. S. Chavan, -"Engineering Chemistry", Laxmi Publishing, New Delhi. Jain & Jain, -"Engineering Chemistry", Dhanpatrai & Co.
3. S. K. Singh, -"Fundamental of Engineering Chemistry", New Age International Publishers.
4. Shikha Agarwal, Engineering Chemistry- Fundamentals and applications, Cambridge Publishers - 2015.

CO-PO Matrix

Course Outcome	Programme Outcome (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	-	-	1	-	1	1	-	1
CO2	2	2	-	-	-	1	-	1	1	-	1
CO3	2	2	-	-	-	1	-	1	1	-	1
CO4	2	2	-	-	-	-	-	1	1	-	1
CO5	2	2	-	-	-	1	-	1	1	-	1
CO6	2	2	-	-	-	-	-	1	1	-	1

Rayat Shikshan Sanstha's
Karmaveer Bhaurao Patil College of Engineering, Satara
An Autonomous Institute

Department of Basic Science & Humanities

Course: F. Y.	Semester: I/II	L	T	P	Credits
Course Code: 26BSHA103/ 26BSHB203	Course Name: Engineering Mechanics	3	-	-	3

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

CO1	Apply fundamental principles of engineering mechanics to analyze force systems, determine resultants, and solve problems involving moments and couples.
CO2	Analyze static equilibrium conditions of coplanar force systems and solve engineering problems involving friction, including block and ladder friction.
CO3	Apply the principles of work, power, energy, momentum, impulse, and impact to analyze the motion and collision of bodies.
CO4	Determine support reactions for beams and analyze simple trusses using the method of joints and the method of sections.
CO5	Calculate centroids, centers of gravity, and moments of inertia of simple and composite plane figures for engineering applications.
CO6	Apply the principles of kinematics and kinetics to solve problems involving linear motion, projectile motion, circular motion, relative velocity, and dynamic analysis of particles and rigid bodies.

Prerequisites: Physics & Mathematics

Unit No.	Description	Hrs.
1	**Introduction and Fundamental principles** **Introduction:** Introduction to Mechanics, Rigid Body, Force and Force Systems, Free Body Diagram, Moment, Couple. **Fundamental principles:** Varignon's theorem. Principle of Transmissibility, Analytical and graphical methods of Resolution and composition of forces, Resultant of Co-planer Concurrent Force System, Co-planer Non-Concurrent Force System,	7
2	**Static Equilibrium:** Introduction & Conditions of Equilibrium, Equilibrium of coplanar concurrent forces, non concurrent forces, and parallel forces. Lami's theorem and its Applications. **Friction:** Basic Definition, Types, **Coulomb's** laws, Application of Friction (Block Friction & Ladder Friction)	7
3	**Work, Power, Energy** Work done by a force, potential energy, kinetic energy of linear motion and rotation, Work Energy principle, Conservation of energy, Conservation of Momentum. Collision of elastic bodies, Impact, Impulse momentum principle.	6

4	**Beams and Trusses** Types of beam, types of supports and loads, beam reactions for simply supported beams **Simple trusses:** Types of trusses, analysis of plane trusses by method of joints and method of sections.	6
5	**Centroid, Center of Gravity and Moment of Inertia:** Introduction, Centriod, Center of Gravity of composite figures. Methods for Finding Moment of Inertia of plane areas, Moment of Inertia of Composite figures	6
6	**Kinematics & Kinetics** **Kinematics of linear motion:** types of motion, laws of motion, kinematics of particles, Problems on rectilinear motion, constant and variable acceleration, motion under gravity, Projectile Motion, Circular motion, concept of relative velocity. **Kinetics of particle:** D'A1embert's principle: applications in linear motion, kinetics of rigid bodies, applications in translation.	7

Reference Books:

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

CO-PO Matrix

Course Outcome	Programme Outcome (PO)/ Programme Specific Outcome(PSO)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2									1		
CO2	3	3		1							1		
CO3	3	2		1							1		
CO4	3	3	2	1							1		
CO5	3	2		1							1		
CO6	3	3	1	1							1		

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Karmaveer Bhaurao Patil College of Engineering, Satara
An Autonomous Institute

Department of Basic Science & Humanities

Course: F. Y.	Semester: I/II	L	T	P	Credits
Course Code: 26BSHA104 / 26BSHB204	Course Name: Basic Mechanical Engineering	2	-	-	2

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

CO1	Explain fundamental concepts of thermodynamics and energy conversion systems.
CO2	Describe the working of IC engines, automobiles and modern mobility systems.
CO3	Select suitable engineering materials and apply basic design and safety concepts.
CO4	Demonstrate the fundamentals of manufacturing processes and machine tool Operations.
CO5	Illustrate the concepts of CNC machining, additive manufacturing, Advance Industry
CO6	Analyze sustainable engineering practices for efficient use of energy and resources.

Prerequisites: Basic knowledge of Science and Mathematics at Higher Secondary level.

Unit No.	Description	Hrs.
1	**Introduction to Mechanical Engineering and Thermodynamics:** Scope of Mechanical Engineering, Engineering applications, Thermodynamic systems, Properties and Processes, Zeroth Law, First Law and Second Law of Thermodynamics, Energy Conversion systems, Applications of thermodynamics in engineering.	5
2	**IC Engines and Sustainable Mobility:** Classification of IC engines, Engine terminology, Two-stroke and Four-stroke engines, SI and CI engines, Automobile systems, Introduction to Electric Vehicles (EVs), Hybrid Vehicles, Future trends in transportation.	4
3	**Engineering Materials and Design Fundamentals:** Ferrous and Non-ferrous materials, Composite materials, Smart materials, Material properties and applications, Machine and Mechanism, Factor of Safety, Introduction to Product Design and Material Selection.	4
4	**Manufacturing Processes and Machine Tools:** Manufacturing systems, Casting process, Machining and Machinability, Lathe Machine, Drilling Machine, Milling Machine, Introduction to CNC machines.	5

Unit No.	Description	Hrs.
5	**Modern Manufacturing Technologies:** Additive Manufacturing (3D Printing), Reverse Engineering, Robotics in Manufacturing, Industry 4.0 and Dark industry Concepts, Smart Manufacturing Systems.	4
6	**Sustainable Mechanical Engineering:** Green Manufacturing, Energy Conservation Techniques, Carbon Footprint, Circular Economy, Sustainable Product Development, Engineering Case Studies.	4

Text Books

1. R. K. Rajput, *Basic Mechanical Engineering*, Laxmi Publications.
2. K. Venugopal, *Basic Mechanical Engineering*, ANE Books.
3. P. K. Nag, *Engineering Thermodynamics*, McGraw Hill.

Reference Books

1. R. S. Khurmi and J. K. Gupta, *Mechanical Engineering*, S. Chand Publications.
2. V. Ganesan, *Internal Combustion Engines*, McGraw Hill.
3. Kalpakjian and Schmid, *Manufacturing Engineering and Technology*, Pearson.
4. S. S. Rao, *Engineering Design*, Pearson.
5. Mikell P. Groover, *Fundamentals of Modern Manufacturing*, Wiley.

CO-PO Matrix

Course Outcome	Programme Outcome (PO)/ Programme Specific Outcome(PSO)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	1		
CO2	3	2	1	-	-	1	-	-	-	-	1		
CO3	3	3	2	-	-	2	-	-	-	-	1		
CO4	3	2	2	1	2	-	-	-	-	-	1		
CO5	2	2	3	1	2	2	1	-	-	-	1		

Rayat Shikshan Sanstha's
Karmaveer Bhaurao Patil College of Engineering, Satara
An Autonomous Institute

Department of Basic Sciences & Humanities

Course: F. Y. B.Tech.	Semester: I / II	L	T	P	Credits
Course Code: 26BSHA105/26BSHB205	Course Name : Communication Skills	2	-	-	2

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

CO1	Demonstrate effective listening, speaking, reading, and writing skills.
CO2	Apply vocabulary, grammar, and phonetics for effective oral and written Communication.
CO3	Communicate confidently in academic and professional environments.
CO4	Prepare workplace documents and digital communications effectively.
CO5	Collaborate and present ideas in multidisciplinary teams.
CO6	Apply communication strategies aligned with Industry 6.0, sustainability, and employability requirements

Detailed Syllabus:

Unit No.	Description	Hrs
1	**Foundations of Communication and Language Skills**	5
	1.1 Communication Fundamentals: • Process and elements of communication, • Types of communication: Verbal, Non-verbal, Formal, Informal • Barriers to communication and strategies to overcome them, **1.2 Listening Skills:** • Definition and Types • Importance of active listening, • Listening for information, instructions, and problem-solving, **1.3 Reading Skills**: • Reading strategies: skimming, scanning, intensive and extensive reading, • Understanding technical texts and manuals, • Reading comprehension : text- Facebook is making us miserable by Daniel Gulati	

2	**Vocabulary Enrichment and English Grammar**	4
	2.1. Vocabulary Enrichment • Vocabulary Enrichment • Word formation and contextual usage **2.2. English Grammar** • Functional grammar in communication- tenses, • Use of articles, auxiliaries and modal auxiliaries • Common errors in speaking and writing **2.3. Introduction to phonetics** • Introduction to Phonemic script • Articulation of different sounds in English • Pronunciation and fluency improvement	
3	**Oral Communication and Interpersonal Skills**	4
	3.1 : Group Communication • Group discussions and team communication • Collaborative problem-solving • Leadership and participation skills **3..2 Presentation Skills** • Planning and organizing presentations • Use of visual aids and presentation • Handling audience questions and feedback **3.3 : Cross-Cultural and Workplace Communication** • Professional etiquettes • Workplace behavior and communication ethics • Communication in global engineering teams	
4	**Professional Writing and Digital Communication**	5
	4.1. Functional Writing • Writing process • Formal and informal correspondence • Summarization and paraphrasing **4.2: Workplace Writing** • Email writing • Letter writing • Technical report writing **4.3: Career Communication** • Resume and CV preparation • Cover letters and statements of purpose • LinkedIn and professional digital profiles	

5	**Digital Communication and AI Tools**	4
	5..1: Digital Communication and AI Tools • AI tools for writing (Jasper , Notion AI , Quillbolt, etc), • AI tool for speaking (Orai, Yodli etc) • Responsible use of AI-assisted communication tools • Digital citizenship and cyber etiquette • Information credibility and fact-checking Definition **5.2 Digital Communication for Entrepreneurs** • Social media communication, • Online branding and content creation , • Digital collaboration tools **5.3 : Project-Based Communication** • Team project communication • Project documentation and reporting • Poster and technical paper presentation	
6	**Employability, Innovation, and Industry 6.0 Communication**	4
	6.1 : Interview and Placement Readiness • HR and technical interview skills • Mock interviews • Professional confidence building **6.1 : Communication for Innovation and Entrepreneurship** • Communication in startups and innovation ecosystems • Creative thinking and idea articulation **6.2 : Human-Centric Communication in Industry 6.0** • Human-machine interaction communication • Ethical communication in AI-driven workplaces • Emotional intelligence and empathy	

Reference Books:

1. Aggarwal Shalini, *Essential Communication Skills,* A Practice –Oriented Approach Books Pvt. Ltd. New Delhi, first edition 2009.
2. Dutt P. Kiramani, Rajeevan Geetha, *Basic Communication Skills*, Cambridge University Press India Pvt. Ltd. New Delhi, 2007 first, reprint 2010.
3. Kumar Sanjay, Pushp Lata, *Communication Skills*, Oxford University Press, New Delhi , 2018 First Edition.
4. Inthira S.R. and Saraswath V. *Enrich Your English*, OUP, New-Delhi 1997.
5. Lester Mark, Tata MC Grew, *Handbook of English Grammar and Usage*, Hill Publishing Company: New Delhi, 2018.
6. Pearson, *Business English, Language, Literature and Creativity*, Orient Blackswan, 2013.
7. Thomson and Marlinet, *A Practical English Grammar*, OUP, New Delhi 1960.
8. Turton, N.D. and Heaton J.B., *Longman Dictionary of Common Errors,* Longman, 1998.
9. Wood John East, *Oxford Practice Grammar*. O.U.P-1999 - Second Edition.
10. Nishitesh, and Bhaskara Reddi, *Soft Skills and Life Skills, The Dynamics of Success.* BSC Publisher, 2012. First Edition

CO-PO Matrix

Course Outcome	Programme Outcome (POs)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	1	3	1	1
CO2	-	-	-	-	-	-	-	3	3	1	1
CO3	-	-	-	-	-	-	-	-	3	-	1
CO4	-	-	-	-	-	-	-	-	3	2	1
CO5	-	1	-	-	-	-	-	1	2	-	3
CO6	-	-	-	-	-	-	1	2	3	2	1

Rayat Shikshan Sanstha's
Karmaveer Bhaurao Patil College of Engineering, Satara
An Autonomous Institute

Department of Basic Sciences & Humanities

Course: F. Y.	Semester: I / II	L	T	P	Credits
Course Code:26 BSHA106/ 26BSHB206	Course Name: Engineering Chemistry Lab	-	-	2	1

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

CO1	Perform standard analytical techniques to determine water quality parameters such as hardness, chloride content, dissolved oxygen, acidity, and alkalinity.
CO2	Apply volumetric and iodometric methods to determine the purity and concentration of chemical substances.
CO3	Measure and analyze the physical properties of engineering fluids and fuels, including surface tension, viscosity, and calorific value.
CO4	Demonstrate the principles and applications of chromatographic separation and polymer synthesis techniques.
CO5	Investigate the corrosion behavior of engineering materials
CO6	Interpret experimental observations, analyze results, draw valid conclusions, and Prepare laboratory reports while following standard laboratory safety and ethical practices.

Prerequisite: Basic knowledge of Chemistry and elementary laboratory techniques at the 10+2 level.

Expt. No.	List of Experiments (Perform any 10 Experiments)
1	Determination of Hardness of water sample by EDTA method.
2	Determination of Chloride content in water samples by precipitation titration method.
3	Determination of Dissolved Oxygen in water by Iodometric method.
4	Determination of Percent purity of Bleaching Powder.
5	Surface tension
6	Viscosity
7	To determine Acidity of water sample.
8	To determine the Calorific value of a fuel.
9	Determination of Acid value of an oil sample.
10	To determine an Alkalinity water sample.
11	Experiments on Chromatography.
12	Preparation of Urea Formaldehyde resin
13	Corrosion

Reference Books:

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

CO-PO Matrix

Course Outcome	Programme Outcome (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	-	-	2	3	2	2	2	-	2
CO2	1	1	-	-	2	3	2	2	2	-	2
CO3	1	1	-	-	2	3	2	2	2	-	2
CO4	1	1	-	-	2	3	2	2	2	-	2
CO5	1	1	-	-	2	3	2	2	2	-	2
CO6	1	1	-	-	2	3	2	2	2	-	2

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Karmaveer Bhaurao Patil College of Engineering, Satara
An Autonomous Institute

Department of Basic Science & Humanities

Course: F. Y.	Semester: I/II	L	T	P	Credits
Course Code:26BSHA107/26BSHB207	Course Name: Engineering Mechanics Lab	-	-	2	1

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

CO1	Apply the principles of coplanar force systems to verify the polygon law of forces and analyze equilibrium conditions in engineering systems.
CO2	Determine forces, support reactions, and mechanical advantage in simple engineering mechanisms such as jib cranes, bell crank levers, and beams.
CO3	Evaluate the centroid and moment of inertia of regular and irregular bodies for engineering applications.
CO4	Analyze frictional behavior on inclined planes and determine the coefficient of friction for different surfaces.
CO5	Verify the law of machines and evaluate the performance characteristics of lifting machines such as screw jacks, worm and worm wheel, and gear crabs.
CO6	Utilize spreadsheet tools for solving and analyzing engineering mechanics problems related to moments, beam reactions, kinematics, and other engineering applications.

At least 10 experiments should be performed from the following list:

Experiment No.	Description	Hrs.
1	Polygon law of co-planar forces	2
2	Study of Forces in Simple Jib Crane	2
3	Bell crank lever	2
4	Support reaction for beam	2
5	Problems on beam reaction by graphics statics method	2
6	Centroid of irregular shaped bodies.	2
7	Moment of Inertia of fly wheel	2
8	Inclined plane (to determine coefficient of friction).	2
9	Verification of law of Machine using Screw jack	2
10	Verification of law of Machine using Worm and Worm Wheel	2
11	Verification of law of Machine using Single and Double Gear Crab	2
12	Application of Spreadsheet Program for concepts like law of moments, beam reactions, problems in kinematics, etc.	2
13	Any Innovative Experiment on Virtual Lab	2

CO-PO Matrix

Course Outcome	Programme Outcome (PO)/ Programme Specific Outcome(PSO)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	1	2				1	1				
CO2	3	3	1	2				1	1				
CO3	3	2		3				1	1				
CO4	3	2	2	3				1	1				
CO5	2	3		2	3			1	1				
CO6	2	2		2	2			1	1				

Course: F. Y.	Semester: I & II	L	T	P	Credits
Course Code: 26BSHA108 /26BSHB208	Course Name: Python Programming Lab	-	–	4	2

COURSE OBJECTIVES:

- To be able to introduce core programming basics and various Operators of Python programming language.
- To demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- To understand Functions, Modules and Regular Expressions in Python Programming.

COURSE OUTCOMES:

CO1 Students should be able to understand the basic concepts of scripting and the contributions of scripting language.

CO2 Ability to explore python data structures like Lists, Tuples, Sets and dictionaries.

CO3 Ability to create practical and contemporary applications using Functions, Modules and Regular Expressions.

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Karmaveer Bhaurao Patil College of Engineering, Satara

An Autonomous Institute

Department of Basic Sciences & Humanities Engineering

S.NO	Name of the Experiment	Remarks
1	a) Demonstrate about Basics of Python Programming.	
	b) Demonstrate about fundamental Data types in Python Programming. (i.e., int, float, complex, bool and string types)	
	c. Demonstrate the working of following functions in Python. i. id( ) ii) type( ) iii) range( )	
	d) Write a Python program to demonstrate various base conversion functions.	
	e) Write a Python program to demonstrate various type conversion functions.	
2	a) Demonstrate the following Operators in Python with suitable examples. i) Arithmetic Operators ii) Relational Operators iii) Assignment Operator iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators	
3	a} Write Python programs to demonstrate the following: i. input( ) ii) print( ) iii) 'sep' attribute iv) 'end' attribute v) replacement Operator ({ })	
	b) Demonstrate the following Conditional statements in Python with suitable examples. i) if statement ii) if else statement iii) if – elif – else statement	
	c) Demonstrate the following Iterative statements in Python with suitable examples. i) while loop ii) for loop	
	d) Demonstrate the following control transfer statements in Python with suitable examples. i) break ii) continue iii) pass	
4	Write Python programs to print the following Patterns:	
	i) A A B A B C A B C D A B C D E	

ii)

```
* * * * *
 * * * *
  * * *
   * *
    *
```

iii)

```
E E E E E E E E E
 D D D D D D D
  C C C C C
   B B B
    A
```

iv]

```
    4
   4 3
  4 3 2
 4 3 2 1
4 3 2 1 0
 4 3 2 1
  4 3 2
   4 3
    4
```

v]

```
4
3 4
2 3 4
1 2 3 4
0 1 2 3 4
1 2 3 4
2 3 4
3 4
4
```

vi]

```
*         *
* *       * *
* * *     * * *
* * * *   * * * *
* * * * * * * * * *
```

vii]

```
**
**
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******
******
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**********
**********
```

	viii) E D E C D E B C D E A B C D E B C D E C D E D E E	
5	a] Write a Python program to demonstrate various ways of accessing the string. By using Indexing (Both Positive and Negative) By using Slice Operator	
	b) Demonstrate the following functions/methods which operates on strings in Python with suitable examples: i) len( ) ii) strip( ) iii) rstrip( ) iv) lstrip( ) v) find( ) vi) rfind( ) vii) index( ) viii) rindex()	
	ix) count( ) x) replace( ) xi) split( ) xii) join( ) xiii) upper( )xiv) lower( ) xv) swapcase( ) xvi) title( ) xvii) capitalize( ) xviii) startswith() xix) endswith()	
6	a) Python program to perform read and write operations on a file.	
	b) Python program to copy the contents of a file to another file.	
	c) Python program to count frequency of characters in a given file.	
	d) Python program to print each line of a file in reverse order.	
	e) Python program to compute the number of characters, words and lines in a file.	
7	a) Demonstrate the different ways of creating list objects with suitable example programs.	
	b) Demonstrate the following functions/methods which operates on lists in Python with suitable examples: i) list( ) ii) len( ) iii) count( ) iv) index ( ) v) append( ) vi) insert( ) vii) extend() viii) remove( ) ix) pop( ) x) reverse( ) xi) sort( ) xii) copy( ) xiii) clear( )	
	c) Demonstrate the following with suitable example programs: i) List slicing ii) List Comprehensions	

8	a) Demonstrate the different ways of creating tuple objects with suitable example programs.	
	b) Demonstrate the following functions/methods which operates on tuples in Python with suitable examples: i) len( ) ii) count( ) iii) index( ) iv) sorted( ) v) min ( ) vi)max( ) vii) cmp( ) viii) reversed( )	
9	a) Demonstrate the different ways of creating set objects with suitable example programs.	
	b) Demonstrate the following functions/methods which operates on sets in Python with suitable examples: i) add( ) ii) update( ) iii) copy( ) iv) pop( ) v) remove( ) vi)discard( ) vii) clear( ) viii) union() ix) intersection( ) x) difference( )	
10	a) Demonstrate the different ways of creating dictionary objects with suitable example programs.	
	b) Demonstrate the following functions/methods which operates on dictionary in Python with suitable examples: i) dict( ) ii) len( ) iii) clear( ) iv) get( ) v) pop( ) vi)popitem( ) vii) keys( ) viii) values() ix) items( ) x) copy( ) xi) update( )	
11	a) Demonstrate the following kinds of Parameters used while writing functions in Python. i) Positional Parameters ii) Default Parameters iii)Keyword Parameters iv) Variable length Parameters	
	b) Write a Python program to return multiple values at a time using a return statement.	
	c) Write a Python program to demonstrate Local and Global variables.	
12	Implement the following Searching and Sorting techniques in Python by using functions. i) Linear Search ii) Binary Search iii) Merge Sort	
13	a) Demonstrate the following in-built functions to use Regular Expressions very easily in our applications. i) compile( ) ii) finditer( ) iii) match( ) iv) fullmatch( ) v) search( ) vi) findall( ) vii) sub( ) viii) subn( ) ix) split( )	
	b)Write a Regular Expression to represent all RGM language (Your own language) identifiers. Rules: The allowed characters are a-z,A-Z,0-9,#. The first character should be a lower case alphabet symbol from a to k. The second character should be a digit divisible by 3. The length of the identifier should be at least 2. c)Write a Regular Expression to represent all 10 digit mobile numbers. Rules: Every number should contains exactly 10 digits. The first digit should be 7 or 8 or 9 Write a python program to check whether the given string is RGM language identifier or not?	

TEXTBOOKS

1 Learning Python, Mark Lutz, Orielly, 3 Edition 2007.
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson, 2017.

REFERENCE BOOKS

1. Think Python, 2 Edition, 2017 Allen Downey, Green Tea Press
2. Core Python Programming, 2016 W.Chun, Pearson.
3. Introduction to Python, 2015 Kenneth A. Lambert, Cengages
4. https://www.w3schools.com/python/python_reference.asp
5. https://www.python.org/doc/

WEB REFERENCES

1. https://www.w3schools.com/python/ + W3 Schools mobile App
2. NPTEL course-Introduction to Python Programming-8 wk course
3. https://www.python.

MAPPING OF COs & POs

Course Outcome	Programme Outcome (PO)/ Programme Specific Outcome (PSO)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2
CO1	3	1	2						1		1	1	1
CO2	3	3	2						1		1	1	1
CO3	3	1	2						1		1	1	1

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Course: F.Y. B.Tech.	Semester: I/II	L	T	P	Credits
Course Code: 26BSHA109/26BSHB209	Course Name: Workshop Practices-I	-	-	4	2

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

CO1	Identify workshop tools, equipment, measuring instruments, and follow safety practices in engineering workshops.
CO2	Perform fitting, carpentry, and sheet metal operations to prepare useful simple engineering jobs/products as per given specifications.
CO3	Execute basic welding, soldering, brazing, and cutting operations following standard workshop procedures.
CO4	Operate conventional workshop machines and produce simple components with required dimensional accuracy.
CO5	Inspect and evaluate fabricated jobs using measuring instruments and quality standards.
CO6	Design and fabricate simple engineering products by integrating workshop skills while considering safety, sustainability, and teamwork.

Prerequisites: --

Course content:

Unit 1: Workshop Safety and Fitting Shop
Introduction to workshop practices and manufacturing processes, Industrial safety rules and personal protective equipment (PPE) , Types of measuring instruments: Steel rule, Vernier caliper, Micrometer, Try square. Fitting tools: Bench vice, Hacksaw, Files, Chisels, Hammers,
Marking and layout operations, Cutting, filing, drilling, tapping, and threading.

Unit 2: Carpentry Shop
Introduction to wood and wood products, Carpentry tools: Saws, Chisels, Planes, Mallets, Marking gauge. Woodworking operations: Cutting, Planning, Chiseling.

Unit 3: Welding Shop
Principles of welding processes, Arc welding equipment and accessories, Welding electrodes and their selection, Welding defects and remedies, Safety precautions in welding, Brazing and soldering fundamentals, Fluxes and filler materials.

Unit 4: Sheet Metal shop
Sheet metal tools and equipment, Marking, cutting, bending and folding operations, Riveting and seam formation.

Unit 5: Machine Shop
Introduction to machine tools, Lathe machine: Construction, Working principle, Operations, Drilling machine, Grinding machine, Cutting tools and tool materials, Cutting parameters

List of Experiments:

Any 10 experiments are to be performed…

Course Content		
Expt. No.	**Description**	**Hrs**
1.	Study of workshop safety practices, PPE, measuring instruments, and fitting tools.	02
2.	Preparation of a male-female fitting (square fitting) job involving marking, sawing, filing, and dimensional inspection.	06
3.	Preparation of a Cross-Halving Joint using standard carpentry tools.	04
4.	Preparation of a T-Lap Joint or Mortise and Tenon Joint.	06
5.	Operate conventional workshop machines and produce simple wooden products.	04
6.	Fabrication of Butt Joint and Lap Joint using Shielded Metal Arc Welding (SMAW).	06
7.	Demonstration and practice of TIG/MIG Welding on thin metal sheets.	04
8.	Brazing of Mild Steel Components Using Oxy-Fuel Flame.	04
9.	Fabrication of an Electrical/electronic components Connection by Soldering Technique.	04
10.	Fabrication of a Tray/Pan using sheet metal operations.	06
11.	Performing centre drilling, facing and plain turning, knurling etc. operations.	04
12.	Drilling and Grinding operations using drilling and bench grinding machines.	04
13.	Operation of CNC/VMC Machine and Preparation of a Simple Component.	04
14.	Demonstration of a PVC pipe plumbing assembly using Tee, Elbow, and Coupling fittings.	02

Reference Books:

1. Workshop Technology, Vol. I & II – S.K. Hajra Choudhury, A.K. Hajra Choudhury and Nirjhar Roy, Media Promoters & Publishers Pvt. Ltd.
2. Workshop Technology – B.S. Raghuwanshi, Dhanpat Rai Publications.
3. Mechanical Workshop Practice – K.C. John, PHI Learning Pvt. Ltd.
4. Manufacturing Processes – H.S. Bawa, Tata McGraw-Hill Education.
5. Workshop Practice – R.K. Singal, Kataria & Sons Publications.

CO-PO Matrix

Course Outcome	Programme Outcome (PO)/ Programme Specific Outcome (PSO)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2
CO1	3	2	-	-	2	-	2	3	2	2	2		
CO2	2	2	3	-	2	2	2	2	2	2	2		
CO3	2	2	3	-	2	-	2	2	2	2	2		
CO4	3	2	2	2	3	-	2	2	2	2	2		
CO5	2	3	-	3	2	-	2	2	2	2	2		
CO6	2	3	3	2	2	2	2	2	3	2	2		

Rayat Shikshan Sanstha's
Karmaveer Bhaurao Patil College of Engineering, Satara
An Autonomous Institute

Department of Basic Sciences & Humanities

Course: F. Y.	Semester: I / II	L	T	P	Credits
Course Code:26BSHA110/26BSHB2 10	Course Name: Communication Skills Laboratory	-	-	2	1

Course Outcomes: After successful completion of the Communication Skills Laboratory, students will be able to:

CO1	Demonstrate effective listening, speaking, reading, and writing skills.
CO2	Apply vocabulary, grammar, and phonetics for effective oral and written communication
CO3	Communicate confidently in academic and professional environments.
CO4	Prepare workplace documents and digital communications effectively.
CO5	Collaborate and present ideas in multidisciplinary teams.
CO6	Apply communication strategies aligned with Industry 6.0, sustainability, and employability requirements

Practical No.	List of Practicals-(Perform any 10)	Hours
1	**Self-Introduction and Personal Profiling**	2
2	**Active Listening and Note-Taking**	2
3	**Pronunciation and Fluency Practice**	2
4	**Vocabulary Building through Technical Contexts**	2
5	**Reading Technical Texts**	2
6	**Group Discussion**	2
7	**Presentation Skills**	2
8	**Email Writing and Digital Etiquettes**	2
9	**Report Writing**	2
10	**Resume and LinkedIn Profile Preparation**	2
11	**Interview Skills and Mock Interview**	2
12	**AI-Assisted Communication**	2
13	**Innovation Pitch Presentation**	2
14	**Team Project Presentation and Portfolio**	2

Reference Books:

1. Aggarwal Shalini, *Essential Communication Skills,* A Practice –Oriented Approach Books Pvt. Ltd. New Delhi, first edition 2009.
2. Dutt P. Kiramani, Rajeevan Geetha, *Basic Communication Skills*, Cambridge University Press India Pvt. Ltd. New Delhi, 2007 first, reprint 2010.
3. Kumar Sanjay, Pushp Lata, *Communication Skills*, Oxford University Press, New Delhi , 2018 First Edition.
4. Inthira S.R. and Saraswath V. *Enrich Your English*, OUP, New-Delhi 1997.
5. Lester Mark, Tata MC Grew, *Handbook of English Grammar and Usage*, Hill Publishing Company: New Delhi, 2018.
6. Pearson, *Business English, Language, Literature and Creativity*, Orient Blackswan, 2013.
7. Thomson and Marlinet, *A Practical English Grammar*, OUP, New Delhi 1960.
8. Turton, N.D. and Heaton J.B., *Longman Dictionary of Common Errors,* Longman, 1998.
9. Wood John East, *Oxford Practice Grammar*. O.U.P-1999 - Second Edition.
10. Nishitesh, and Bhaskara Reddi, Soft *Skills and Life Skills, The Dynamics of Success.* BSC Publisher, 2012. First Edition

CO-PO Matrix

Course Outcome	Programme Outcome (POs)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-	-	1	3	1	1
CO2	-	-	-	-	-	-	-	-	3	-	1
CO3	-	1	-	-	-	-	-	-	2	-	3
CO4	-	-	-	-	-	-	1	3	3	1	1
CO5	-	1	-	-	-	-	1	2	3	2	1
CO6	-	-	-	-	-	-	-	-	3	2	1

Course: F. Y.	Semester: I & II	L	T	P	Credits
Course Code: 26BSHA111A/26BSHB211A	Course Name: Sports & Physical Education	-	–	2	1

Course Objective:

1. Develop physical fitness, strength, flexibility, endurance and coordination among students.
2. Create awareness about the importance of regular physical activity and a healthy lifestyle.

Course Outcomes:

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

CO1 Demonstrate basic physical fitness, flexibility, strength, endurance and coordination through appropriate exercises.

CO2 Perform fundamental skills and techniques of selected indoor and outdoor sports.

CO3 Apply principles of teamwork, discipline, leadership and sportsmanship during sports activities.

List of Practicals- *Perform any 10*

1. **Physical Fitness Assessment** – Assess basic fitness parameters such as BMI, endurance, strength and flexibility.
2. **Warm-up and Cool-down Exercises** – Practice appropriate warm-up and cool-down techniques before and after physical activity.
3. **Yoga and Surya Namaskar** – Perform basic yoga postures and Surya Namaskar for physical and mental well-being.
4. **Running and Endurance Training** – Perform running and endurance exercises to improve cardiovascular fitness.
5. **Strength and Conditioning Exercises** – Practice basic body-weight exercises for muscular strength and conditioning.
6. **Flexibility Training** – Perform stretching exercises to improve flexibility and mobility.
7. **Cricket Skills** – Practice basic skills such as batting, bowling, fielding and catching.
8. **Football Skills** – Practice passing, dribbling, shooting and basic game techniques.
9. **Volleyball Skills** – Practice serving, passing, setting and spiking techniques.
10. **Basketball Skills** – Practice dribbling, passing, shooting and basic defensive skills.
11. **Badminton Skills** – Practice basic grip, service, strokes and court movement.
12. **Table Tennis Skills** – Practice basic grip, service, forehand, backhand and rally techniques.

13. **Athletics Activities** – Practice basic running, jumping and throwing events.
14. **Sports Safety and First Aid** – Demonstrate basic safety measures and first-aid practices for common sports injuries.
15. **Team Sports and Sportsmanship Activity** – Participate in a team game and demonstrate cooperation, leadership, discipline and fair play.

Reference-

- **J. R. Sharma**, *Physical Education and Sports*, Khel Sahitya Kendra, New Delhi.
- **R. P. Sharma**, *Health and Physical Education*, Khel Sahitya Kendra, New Delhi.
- **V. K. Sharma**, *Health and Physical Education*, Saraswati House.
- **Dr. A. K. Uppal**, *Physical Education and Health*, Friends Publications, New Delhi.
- **Dr. M. L. Kamlesh**, *Physical Education and Sports*, Friends Publications, New Delhi.
- **Dr. D. K. Kansal**, *Test and Measurement in Sports and Physical Education*, DVS Publications.

Course: F. Y.	Semester: I & II	L	T	P	Credits
Course Code: 26BSHA111B/26BSHB211B	Course Name: Music and Dance	-	–	2	1

Course Objective:

1. Develop students' interest, creativity and appreciation for music and dance.
2. Introduce students to the basic concepts, techniques and forms of music and dance.
3. Develop rhythm, coordination, body movement and artistic expression.

Course Outcomes:

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

CO1 Identify basic concepts, forms and elements of music and dance.

CO2 Demonstrate basic rhythm, movement, coordination and performance techniques.

CO3 Perform selected vocal, instrumental or dance activities individually and in groups.

CO4 Apply creativity and artistic expression in music and dance performances

List of Practicals- *Perform any 10*

1. **Introduction to Rhythm and Beat** – Practice basic beats, rhythm patterns and tempo through simple exercises.
2. **Basic Vocal Music Practice** – Practice basic swaras, pitch and simple vocal exercises.
3. **Breathing and Voice Modulation** – Practice breathing techniques and voice control for singing and performance.
4. **Basic Instrumental Music** – Learn and practice basic techniques on a selected musical instrument.
5. **Indian Folk Music Activity** – Learn and perform a selected Indian folk song.
6. **Indian Classical Music Activity** – Practice basic elements of Hindustani or Carnatic classical music.
7. **Basic Dance Movements** – Practice fundamental body movements, postures and coordination.
8. **Indian Classical Dance Activity** – Learn and perform basic steps or movements from a selected classical dance form.

9. **Indian Folk Dance Activity** – Practice and perform a selected regional folk dance.
10. **Rhythm and Footwork Practice** – Develop coordination between music, rhythm and dance movements.
11. **Expression and Abhinaya Activity** – Practice facial expressions, gestures and emotional expression through dance.
12. **Group Music Performance** – Prepare and perform a group song with appropriate rhythm and coordination.
13. **Group Dance Performance** – Prepare and perform a choreographed group dance demonstrating teamwork and synchronization.
14. **Fusion Music and Dance Activity** – Create a short performance combining traditional and contemporary elements.
15. **Stage Performance** – Present an individual or group music/dance performance demonstrating confidence, creativity and stage discipline.

Reference-

- **V. N. Bhatkhande**, *Kramik Pustak Malika*, Sangeet Karyalaya, Hathras.
- **Vishnu Narayan Bhatkhande**, *Hindustani Sangeet Paddhati*, Sangeet Karyalaya, Hathras.
- **V. N. Bhatkhande**, *A Comparative Study of Some of the Leading Music Systems of the 15th, 16th, 17th and 18th Centuries*, Sangeet Karyalaya.
- **Vishnu Digambar Paluskar**, *Sangeet Bal Prakash*, Gandharva Mahavidyalaya Mandal, Mumbai.
- **Kapila Vatsyayan**, *Indian Classical Dance*, Publications Division, Ministry of Information and Broadcasting, Government of India.

Course: F. Y.	Semester: I & II	L	T	P	Credits
Course Code: 26BSHA111C / 26BSHB211C	Course Name: Yoga Education	-	–	2	1

Course Objective:

1. To learn Message of Vedas and Upanishads
2. To learn Four Streams of Yoga,
3. To learn Shaddarshanas or the SIX systems of Indian Philosophy,
4. To understand Life and message of spiritual masters and Indian Culture
5. To understand Anatomy and Physiology, Yoga and Exercise Physiology

Course Contents: List of Practicals (Perform any 10)

1. Know Your Starting Point: Baseline Body–Mind Assessment
2. Engineering Body: Posture & Spinal Mobility
3. Surya Namaskar: A Complete Movement System
4. Build Your Foundation: Strength, Stability & Balance
5. Flexibility ≠ Mobility: Joint Mobility Laboratory
6. The Breath Lab: Yogic Breathing & Breath Awareness
7. Nadi Shodhana & Bhramari: Breath & Self-Regulation
8. Concentration Engine: Dharana & Attention Training
9. Stress Management Lab: Yoga for Academic Stress
10. Four Streams of Yoga: Karma, Bhakti, Jnana & Raja Yoga
11. Inner Engineering: Pratyahara, Dharana & Dhyana
12. The Six Systems of Indian Philosophy: Shaddarshana Activity Lab
13. Human Performance Lab: Pulse, Respiration & Recovery
14. Pancha Kosha & Holistic Health Laboratory
15. Engineer Your Own Yoga Routine: Final Integrated Practical

Text Books:

1. Rajayoga - Swami Vivekananda - Ramakrishna Ashrama Publications.
2. Hathayoga Pradipika of Swatmarama - Kaivalyadhama, Lonavala
3. The Science of Yoga - Taimini - Theosophical Publishing House, Adyar, Madras.
4. Yogasutras of Patanjali - Harihara nanda Aranya, University of Calcutta Press, Calcutta.

Reference Books:

1. Patanjal Yoga Pradeepa Omananda Tirtha- Geeta Press, Gorakhpur.
2. Gherandasamhita - Bihar School of Yoga, Munger, Bihar.
3. Shivayogadipika - Sadashivabrahmendra, Ananda Ashramagranthavali, Choukhamba Press.
4. Yoga Darshan: Swami Niranjanananda-Sri Panchadashanam Paramahamsa Alakh Bara, Deoghar.
5. Four chapters on Freedom (commentary on the Yoga sutras of Patanjali), Swami Satyananda (1983), Bihar School of Yoga, Munger.

Course: F. Y.	Semester: II	L	T	P	Credits
Course Code: 26BSH201	Course Name: Engineering Mathematics II	3	-	-	3

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

CO1	Apply first and higher-order partial differentiation, total derivatives, and change of variables to solve multivariable system equations and simplify homogeneous functions using Euler's Theorem.
CO2	Compute Jacobian of functions of several variables and their applications to engineering problems
CO3	Apply numerical differentiation methods for practical engineering and scientific problems.
CO4	Analyze and solve differential equations using suitable transformations and solution techniques.
CO5	Apply the knowledge differential and integral calculus for curve tracing, rectification And evaluation of multiple integrals.
CO6	Evaluate multiple Integrals and their applications to area and volume

Prerequisites: Basics of Mathematics

Unit No.	Description	Hrs.
1	Partial Differentiation: Partial derivatives of first and higher orders; Homogeneous functions – Euler's Theorem for functions containing two and three variables (without proofs); Total derivatives; Change of variables.	7
2	Application 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;	7
3	Numerical Differentiation : Newton's forward difference formula, Newtons Backward difference formula, Stirling's formula	6
4	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 non-homogenous equation.	7
5	Reduction Formulae and Curve Tracing : Reduction formulae, for tracing of standard curves given in Cartesian forms (Semi-cubical parabola ,strophoid ,Cissoid of diocles ,Lemniscate of Bernaulli) and polar forms (Cardoid , 3 Leaved rose , Limacon)	6
6	Multiple Integral : 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	6

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publications
2. A Text Book of Applied Mathematics Vol. I, P. N. Wartikar&J. N. Wartikar

Reference Books:

1. Advanced Engineering Mathematics (10th edition) by Erwin Kreyszig, Wiley Eastern Ltd.
2. Linear Algebra (3rd edition) by Serge Lang, Springer.
3. Linear Algebra and its applications (4th edition) by Gilbert Strang, Cengage Learnings (RS).
4. Elementary Linear Algebra (10th edition) by Howard Anton and Chris Rorres, John Wiley, and sons.

CO-PO Matrix

Course Outcome	Programme Outcome (PO)/ Programme Specific Outcome(PSO)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO -	PSO -
CO1	3	2	-	-	-	-	1	1	-	-	1	-	-
CO2	3	2	-	-	-	-	1	1	-	-	1	-	-
CO3	3	2	-	-	-	-	1	1	-	-	1	-	-
CO4	3	2	-	-	-	-	1	1	-	-	1	-	-
CO5	3	2	-	-	-	-	1	1	-	-	1	-	-
CO6	3	2	-	-	-	-	1	1	-	-	1	-	-

Rayat Shikshan Sanstha's
Karmaveer Bhaurao Patil College of Engineering, Satara
An Autonomous Institute

Department of Basic Sciences & Humanities

Course: F. Y.	Semester: I & II	L	T	P	Credits
Course Code: 26BSHB102/26BSHA202	Course Name: Engineering Physics	3		-	3

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

CO1	Describe acoustics and ultrasonic wave generation with their applications.
CO2	Describe smart materials and their engineering applications.
CO3	Classify nanomaterial's and relate their properties to engineering applications.
CO4	Apply interference and polarization principles to use optical phenomena in engineering applications.
CO5	Assess the role of optical fibers and lasers in communication and engineering applications.
CO6	Apply quantum mechanics to study particle behavior and modern technologies.

Unit No.	Description	Hrs.
1	**Unit1: Acoustics & Ultrasonic** **Acoustics:** Introduction, Reflection of sound (reverberation and echo), absorption coefficient, Sabine's formula, Acoustical planning of building and factors affecting architectural acoustics of building. **Ultrasonic Waves**: Properties of Ultrasonic Waves, Production of ultrasonic waves: Magnetostriction method and Piezoelectric method, Problems & Applications (any three in detail).	6
2	**Unit-2 Smart Materials** **Magnetic Materials:** Types of magnetic materials, magnetic domain and hysteresis curve, Engineering applications of magnetic materials(Memeristor, transformer, receiver) **Semiconductors:** Conductivity of semiconductors, Hetrojunction materials for semiconductors device (GaAS, AlGaAs, III Nitride Alloys),Hall Effect (derivation & Applications) , Solar cell (Numerical) **Superconductors:** Definition, critical temperature, critical magnetic field, Meissner effect, type I & II superconductors, applications (quantum computing devices & Maglev train)	7
3	**Unit-3 : Nanophysics** Introduction to Nanoscience and Nanophysics, Comparison between bulk materials	6

	and nanomaterial's, Classification of nanomaterial's (0D, 1D, 2D & 3D), Properties of nanomaterial's, Synthesis of nanomaterial's: Top down (ball milling) & Bottom up (sol-gel method), Examples of nanomaterial's (nanoparticles, CNT, quantum dots), Characterization techniques: XRD & FESEM, Engineering applications (Nanoelectronics and sensors, Energy storage devices, water purification)	
4	**Unit -4: Interference & Polarization** **Interference** -Interference in thin film due to reflected light, Wedge shaped film, Newton' Rings (Experimental arrangement, diameter of dark & bright ring), Application of Newton's ring (Wavelength of incident light or radius of curvature of Plano convex lens) **Polarization:** Introduction, Polarized & unpolarized light, types of polarization, Optical activity & Specific rotation (Definition and examples), Lorentz Half Shade polarimeter.	7
5	**Unit-5: Optical Fiber and Laser** **Optical fiber**: Introduction to optical fiber, principle of operation, Acceptance cone, Numerical aperture, applications of fiber optics and examples. **Lasers:** Introduction to lasers, Basic Principles of Laser Operation(Metastable state, population inversion, pumping, resonant cavity),He-Ne Laser, Fiber Laser, Applications of Lasers	6
6	**Unit-6: Quantum Mechanics** **Quantum Mechanics** – Matter waves and De- Broglie hypothesis (Wave-particle duality), Quantum operator (Position, momentum), Heisenberg's uncertainty principle and its application (Absence of electrons within the nucleus) Wave function and its physical significance, Schrodinger's time dependent and independent wave equation, Particle in a box (1Dimensional), Conceptual discussion: Quantum tunneling & quantum computing.	7

Text Books:

1. **Engineering Physics** -Author: Dr. Abhijit Nayak ,Publisher: S.K. Kataria & Sons, New Delhi
2. **Engineering Physics** -Author: G. Aruldhas ,Publisher: PHI Learning Pvt. Ltd., New Delhi

Reference Books:

1. **Optics** -Author: Ajoy Ghatak ,Publisher: McGraw-Hill Education, India
2. **Lasers and Nonlinear Optics** -Author: B.B. Laud ,Publisher: New Age International Publishers, New Delhi
3. **Introduction to Quantum Mechanics** -Author: David J. Griffiths ,Publisher: Pearson Education
4. **Principles of Quantum Mechanics** -Author: R. Shankar ,Publisher: Plenum Press, New York
5. **Solid State Physics** -Author: N.W. Ashcroft & N.D. Mermin ,Publisher: Cengage Learning / Brooks Cole
6. **Materials Science and Engineering** -Author: V. Raghavan ,Publisher: Prentice Hall of India (PHI)
7. **Nanoscience and Nanotechnology** -Author: K.K. Chattopadhyay & A.N. Banerjee ,Publisher: PHI Learning Pvt. Ltd., New Delhi

CO-PO Matrix Correlation Levels: 1–Low, 2–Moderate, 3–High)

Course Outcome	Programme Outcome (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	–	–	–	–	1	–	–	–	1
CO2	3	1	–	–	–	–	1	–	–	–	1
CO3	3	1	–	–	–	–	1	–	–	–	1
CO4	3	1	–	–	–	–	1	–	–	–	1
CO5	3	1	–	–	–	–	1	–	–	–	1
CO6	3	1	–	–	–	–	1	–	–	–	1

Rayat Shikshan Sanstha's
Karmaveer Bhaurao Patil College of Engineering, Satara An
Autonomous Institute
Department of Basic Sciences & Humanities Engineering

Course: F. Y.	Semester: I & II	L	T	P	Credits
Course Code: **26BSHB103 / 26BSHA203**	**Course Name: Engineering Graphics**	3	–	–	3

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

CO1	Describe engineering drawing standards, conventions, scales, dimensioning, and geometrical construction techniques
CO2	Construct projections of points, lines, planes and auxiliary views in different orientations.
CO3	Draw orthographic projection and sectional views of engineering components.
CO4	Apply projection principles to draw solids, sectional views, and auxiliary views
CO5	Develop surface layouts of solids for manufacturing applications.
CO6	Enhance visualization skills for interpreting and reading engineering drawings using CAD

Prerequisites: Basic Geometric shapes and measurements

Unit No.	Description	Hrs.
1	**Drawing standards and Geometrical construction:** Drawing standard SP: 46, usage of drawing instruments, Type of lines, lettering, dimensioning, conventions, Scales: Plain, Diagonal and Vernier Scale **Geometrical construction**: Drawing a regular polygon given one side, special methods of constructing a pentagon and a hexagon	4
2	**Projections of Points , Straight Lines and their Traces -**Projection of points lying in four quadrants, Projections of lines parallel and perpendicular to one or both planes, projections of lines inclined to one or both planes. Traces of lines **Part B : Projections of planes** parallel and perpendicular to one or both planes, projection of planes inclined to one or both planes. Auxiliary Plane	8
3	**Orthographic Projections** Principle of Projection, Methods of projection First Angle & Third Angle, Introduction to orthographic projection, Drawing of orthographic views of objects from their isometric views. Reading a Sectional Views;	8

Unit No.	Description	Hrs.
4	**Part A Projections of Solids-**Types of solids, Projections of solids with axis perpendicular and parallel to HP and VP, solids with axis inclined to one or both the planes. **Sections of solids-**Sections of solids, Section planes perpendicular to one plane and parallel or inclined to other plane	8
5	**Development of Surfaces-** Method of development Parallel Line & Radial Developments Developments of lateral surfaces of right solids **Isometric projections:** Isometric scale, drawing of isometric projections from given orthographic views	8
6	**Introduction to CAD** Introduction to GUI of CAD software, Basic operations of CAD software, Draw commands for 2D drawings, Editing commands, Dimensioning styles and plotting in CAD	3

Text Books &

- Bhatt, N.D., 2011. Engineering Drawing. Engineer, 4, p.2.
- K. V. Nataraajan, A text book of Engineering Graphic, Dhanalakshmi Publishers, Chennai, 2006.
- K. Venugopal and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd, 2008.
- Dhananjay A. Jolhe, Engineering Drawing with an Introduction to AutoCAD, McGraw Hill Education, 2017

Reference Books:

A Textbook of Engineering Drawing. By R. K. Dhawan. Revised ed., S. Chand and Co., 2008.
Engineering Drawing. By N. B. Shaha and B. C. Rana. 2nd ed., Pearson Education, 2012
Machine Drawing. By K. L. Narayana. New Age Publication.

CO-PO Matrix

Course Outcome	Programme Outcome (PO)/ Programme Specific Outcome(PSO)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	1	-	-	-	1	-	-	-	-	-	1	-	-
CO2	1	1	1	2	1	-	-	-	-	-	1	-	-
CO3	1	-	2	2	1	-	-	-	-	-	1	-	-
CO4	1	1	1	1	-	-	-	-	-	-	1	-	-
CO5	1	1	2	-	1	-	1	1	1	-	1		
CO6	1	1	2	-	2	-	1	1	1	1	1		-

Course: F. Y.	Semester: I /II	L	T	P	Credits
Course Code: 26BSHB104/26BSHA204	Course Name: Basic Civil Engineering	2		-	2

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

CO1	Describe the role of Civil Engineering, building planning principles, and building bye-laws in infrastructure development.
CO2	Explain the properties, applications, and selection criteria of common building materials and structural systems.
CO3	Identify and Explain the basic components of a structure, including substructure and superstructure and their functions.
CO4	Explain surveying techniques for measurement of distances, bearings, areas, & elevation and Describe the applications of Electronic Distance Measurement (EDM)
CO5	Explain the fundamentals of transportation systems and the role of highways, railways, airports, harbors, and waterways in economic development.
CO6	Explain the basic concepts of Environmental, and Irrigation Engineering and their relevance to sustainable development.

Unit No.	Description	Hrs.
1	**Introduction to Civil Engineering** Introduction of branches of civil engineering, Principles of planning, Introduction to Bye-Laws regarding building line, height of building, open space requirements, F.S.I., setbacks, ventilation, sanitation as per Municipal Corporation area requirement.	5
2	**Building Materials** Uses and properties of Concrete, Ingredients and grades of concrete, Plain and Reinforced cement concrete and Special concrete types like RMC, FRC, Bricks, AAC Blocks, Hollow Clay Blocks, Steel, Timber, Engineered Wood Products, Smart Roofing materials etc. , Glass types and uses,	4
3	**Components of structure** **Sub-structure**: Types of soil and rocks as foundation strata, concept of bearing capacity, types of foundations i.e. shallow and deep and their suitability. Shallow foundation such as wall foundation, isolated foundation, deep foundation such as pile foundation. **Superstructure:** Elements of super-structures and their functions	4

4	**Surveying & Levelling** Surveying: Principles of surveying, Classification of surveys, Chain Survey, Compass Survey, Chain and compass Survey, Theodolite Survey, Total Station Survey. Elements of Angular measurement: Meridian, bearing and its types, system of bearing, prismatic and surveyor's compass. Leveling: Dumpy level and Auto Level, Total station, Methods of reduction of levels, Contours, characteristics of contours, use of contour maps, Introduction and use of EDM's, Introduction to Remote sensing	6
5	**Introduction to Transportation Engineering** Highway Engineering: Classification of Roads, Typical cross section of Road, Types of Bridges, Tunnels, Railway Engineering: Components of railway track (Broad Gauge). advancement in railway engineering, Airports Engineering: Airport infrastructure and functional areas, ICAO, FAA, DGCA and AAI standards, Air traffic controls. Waterways: Importance of water transport, Docks and Harbour,	4
6	**Introduction to Environmental Engineering**: Components of water supply scheme (flow diagram), water and waste water Treatment, Air Pollution its sources and control measures **Introduction to Irrigation Engineering:** Necessity of Irrigation, Methods of Irrigation, Types of Dams (Earthen and Gravity Dam), Smart Dam Monitoring	3

Text Books:

1. Anurag Kandya, —Elements of Civil Engineering||, Charotar Publishing, Anand
2. Sushil Kumar, —Building Construction||, Standard Publishers Distributors
3. Kanetkar T. P. and Kulkarni S. V., —Surveying and Levelling, Vols. I, II and III, Vidyarthi Gruh Prakashan, Pune
4. G. K. Hiraskar, —Basic Civil Engineering||, Dhanpat RaiPublications

Reference Books:

1. S. C. Rangwala, Building Construction, Charotar Publishing House.
2. P. C. Varghese, Building Materials, PHI Learning.
3. S. K. Khanna, C. E. G. Justo and A. Veeraragavan, Highway Engineering, Nem Chand & Bros
4. Peavy, Rowe and Tchobanoglous, Environmental Engineering, McGraw Hill.

CO-PO Matrix

Course Outcome	Programme Outcome (PO)/ Programme Specific Outcome(PSO)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2
CO1	3	2	-	-	-	2	-	-	-	-	1	-	-
CO2	3	2	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	-	-	-	-	-	-	-	-	1	-	-
CO4	3	3	1	2	2	-	-	-	-	-	1	-	-
CO5	3	3	1	2	2	-	-	-	-	-	1	-	-
CO6	2	2	-	-	-	3	-	-	-	-	2	-	-

Rayat Shikshan Sanstha's
Karmaveer Bhaurao Patil College of Engineering, Satara
An Autonomous Institute

Department of Basic Sciences & Humanities

Course: F. Y.	Semester: I & II	L	T	P	Credits
Course Code: 26BSHB105/26BSHA205	Course Name: Engineering Physics Lab	0	0	2	1

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

CO1	Perform experiments to verify principles of acoustics, ultrasonic and wave optics.
CO2	Analyze interference, diffraction, and polarization through optical experiments.
CO3	Operate optical fiber and laser systems and analyze their characteristics.
CO4	Determine physical constants using semiconductor physics and quantum mechanics principles.
CO5	Analyze magnetic and material properties using experimental methods.
CO6	Interpret XRD patterns and FESEM images for nanomaterial characterization.

Expt. No.	Description
1	**Ultrasonic interferometer**: To determine the velocity of ultrasonic waves through liquid
2	**Newton's rings:** To determine the wavelength of monochromatic light using Newton's rings.
3	**Polarimeter:** To calculate specific rotation of sugar solution.
4	**Planck's constant: To** determine **Planck's constant (h)** using LEDs of different wavelengths.
5	**LASER:** To determine the divergence and wavelength of semiconductor laser.
6	**Optical Fiber Cable** -To determine the numerical aperture and acceptance angle
7	**Nanomaterial's**- Characterization of Nanomaterial's using XRD and FESEM Data
8	**Hall effect-** To determine the Hall coefficient, mobility and charge carrier in a given semiconductor
9	**Band gap energy:** To determine band gap energy of given semiconductor.
10	**P-N Junction diode:** To study I-V characteristics of P-N junction diode.
11	**Wedge shaped thin Film**- Determination of thickness of small object using air wedge.
12	**B-H Curve**- Determination of retentivity, coercivity, and energy loss in ferromagnetic material using hysteresis curve.

[Note- At least 10 experiments to be performed]

Experiment–CO Mapping Table

Exp. No.	Experiment Title	CO1	CO2	CO3	CO4	CO5	CO6
1	Ultrasonic Interferometer (velocity of ultrasonic waves)	✓	–	–	–	–	–
2	Newton's Rings (wavelength of light)	✓	✓	–	–	–	–
3	Polarimeter (specific rotation)		✓				
4	Planck's constant	–	✓	–	–	–	–
5	Laser (divergence & wavelength)	–	✓	✓	–	–	–
6	Optical Fiber (NA & acceptance angle)	–	–	✓	–	–	–
7	Nanomaterial's	–	–	–	–	–	✓
8	Hall Effect (Hall coefficient, mobility)	–	–	–	✓	✓	–
9	Band Gap Energy (semiconductor)	–	–	–	✓	✓	–
10	P-N Junction Diode (I-V characteristics)	–	–	–	✓	✓	–
11	Wedge Shaped Film (thickness measurement)	✓	✓	–	–	–	–
12	B-H Curve (magnetic properties)	–	–	–	–	✓	–

CO-PO Matrix Correlation Levels: 1–Low, 2–Moderate, 3–High)

Course Outcome	Programme Outcome (PO)										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	–	–	–	–	–	2	1	1	–	2
CO2	3	–	–	–	–	–	2	1	1	–	2
CO3	3	–	–	–	–	–	2	1	1	–	2
CO4	3	–	–	–	–	–	2	1	1	–	2
CO5	3	–	–	–	–	–	2	1	1	–	2
CO6	3	–	–	–	–	–	2	1	1	–	2

Rayat Shikshan Sanstha's
Karmaveer Bhaurao Patil College of Engineering, Satara
An Autonomous Institute

Department of Basic Sciences & Humanities Engineering

Course: F. Y.	Semester: I & II	L	T	P	Credits
Course Code: 26BSHB106 / 26BSHA206	Course Name: Engineering Graphics Laboratory	-	-	4	2

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

CO1	Apply engineering drawing standards, conventions, and dimensioning techniques to prepare technical drawings.
CO2	Construct orthographic projections of points, lines, planes, and solids with respect to reference planes.
CO3	Prepare sectional views, surface developments, and isometric projections of engineering solids.
CO4	Draw orthographic and isometric drawings of engineering components.
CO5	Utilize CAD software to prepare engineering drawings
CO6	Develop program-specific engineering drawings using CAD tools

Prerequisites: Basic Geometric shapes and measurements

Minimum 10 experiments are to be performed based on contents from syllabus Sample

Sr. NO	List of Experiments:
Sheet no. 1	Lines ,Lettering Dimensioning
Sheet no.2	Projections of Points & Lines
Sheet no.3(CAD)	Introduction to CAD Task 1 Draw & modify using CAD Task 2 Geometric Constructions using CAD
Sheet no.4	Orthographic Projection any Industrial Component
Sheet no.5	Orthographic Projection with sectional view any Industrial Component
Sheet no.6 (CAD)	Orthographic Projection 2D Drawing Using CAD
Sheet no.7	Projections of Planes

Rayat Shikshan Sanstha's
Karmaveer Bhaurao Patil College of Engineering, Satara
An Autonomous Institute

Department of Basic Sciences & Humanities Engineering

Course: F. Y.	Semester: I & II	L	T	P	Credits
Course Code: 26BSHB106 / 26BSHA206	Course Name: Engineering Graphics Laboratory	-	-	4	2

Sr. NO	List of Experiments:
Sheet no.8	Projections of Simple Solids
Sheet no.9	Projections of Section of Solids
Sheet no.10	Development of Surfaces
Sheet no.11	Isometric Projection of any Industrial Component
Sheet no.12(CAD)	Isometric 3D Drawing Using CAD
Sheet no.13(CAD)	Application of CAD-Branch specific Drawing

CO-PO Matrix

Course Outcome	Programme Outcome (PO)/ Programme Specific Outcome(PSO)												
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2
CO1	1	-	-	-	1	-	-	-	-	-	1	-	-
CO2	1	1	1	2	1	-	-	-	-	-	1	-	-
CO3	1	-	2	2	1	-	-	-	-	-	1	-	-
CO4	1	1	1	1	-	-	-	-	-	-	1	-	-
CO5	1	1	2	-	1	-	1	1	1	-	1	-	-
CO6	1	1	2	-	1	-	1	1	1	-	1	-	-

Rayat Shikshan Sanstha's
Karmaveer Bhaurao Patil College of Engineering, Satara
An Autonomous Institute

Department of Basic Sciences & Humanities

Course: F. Y.	Semester: I/II	L	T	P	Credits
Course Code: 26BSHA207/ 26BSHB107	Course Name: Basics in AI-IoT & Robotics Automation Lab (Basics in AI-I-RA Lab)	-	-	4	2

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

CO1	Create AI, ML, HPC, and IoT-based conceptual models for engineering product development.
CO2	Interface sensors with Arduino, Raspberry Pi, and NodeMCU ESP8266 platforms to acquire, process, and transmit real-time data for smart applications.
CO3	Develop and evaluate electrical circuit and motor-based subsystems using R-L-C circuits, DC motors, AC motors, and starter mechanisms.
CO4	Construct and validate electrical network models using Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL).
CO5	Develop prototype solutions incorporating robotics, mechatronics, electro-pneumatic systems, and Industry 4.0 technologies.
CO6	Create and fabricate engineering prototypes using 3D printing and evaluate components using 3D scanning technologies.

Prerequisites: Basics of Sensors, digital devices, Computer Fundamentals, and Interest in AI, IoT, Robotics, and Automation

List of Experiments:

1. Introduction to AI, IoT, Robotics, Industry 4.0 and laboratory safety.
2. Create a simple AI workflow for image classification using AI tools.
3. Create an AI model for prediction using supervised machine learning.
4. Interface LED, Push Button and Buzzer with Arduino UNO.
5. Interface Temperature and Humidity Sensor (DHT11/DHT22) with Arduino.
6. Interface Gas Sensor (MQ Series) with Arduino.
7. Interface LDR and IR Sensor with Arduino for automatic lighting.
8. Interface Ultrasonic Sensor for distance measurement.
9. Interface Sound and Vibration Sensors with Node MCU ESP8266.
10. Develop an HTML-based IoT Dashboard using Node MCU ESP8266.

11. Develop Wi-Fi-based Home Automation using ESP8266 and Relay Module.
12. Interface Servo Motor and DC Motor with Arduino.
13. Interface Stepper Motor using ULN2003/L298 Driver.
14. Control DC Motor Speed using PWM Technique.
15. Raspberry Pi GPIO programming using Python.
16. Raspberry Pi based Camera Interface and Image Capture.
17. Raspberry Pi based Environmental Monitoring System.
18. Construct Electrical Networks and verify Kirchhoff's Voltage Law (KVL).
19. Construct Electrical Networks and verify Kirchhoff's Current Law (KCL).
20. Analyze R-L-C Series Circuit under AC Supply.
21. Perform AC Motor Starter Demonstration (DOL/Star-Delta Simulation).
22. Develop a Line Following Robot.
23. Develop an Obstacle Avoiding Robot.
24. Develop an Electro-Pneumatic/ Mechatronics Automation System.
25. Develop a Mini Industry 4.0 Smart Manufacturing Demonstration using Sensors, PLC/Controller and IoT.
26. Design, Fabricate and Demonstrate an Integrated AI-IoT-Robotics Prototype using 3D Printing/3D Scanning Technology.

Note: -Minimum 20 Experiments should be conducted.

Rayat Shikshan Sanstha's
Karmaveer Bhaurao Patil College of Engineering, Satara
An Autonomous Institute

Department of Basic Sciences & Humanities

CO-PO Mapping Matrix

Course Outcome	Programme Outcome (PO)/ Programme Specific Outcome (PSO)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	1	-	-	-	-	-	-			
CO2	3	2	1	1	2	-	-	-	-	-	-			
CO3	3	2	1	1	-	-	-	-	-	-	-			
CO4	3	2	1	1	1	-	-	-	-	-	-			
CO5	3	2	2	1	2	-	-	-	-	-	-			
CO6	3	3	2	2	3	1	1	-	1	-	-			

Basic Science and Humanities (BSH)					
Course: F. Y.	**Semester: I/II**	**L**	**T**	**P**	**Credits**
Course Code: 26BSHB108 / 26BSHA208	**Course Name: Design Thinking**	**-**	**-**	**4**	**2**

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

CO1	Apply empathy and observation techniques to identify user needs and societal challenges.
CO2	Analyze problems and formulate clear problem statements using Design Thinking tools.
CO3	Generate innovative solutions using ideation and creative thinking techniques.
CO4	Develop and validate prototypes using appropriate testing methodologies.
CO5	Demonstrate teamwork, communication, project management and entrepreneurial thinking through Design Thinking projects.

Laboratory Activities. Any 12 Activity from below

Sr No	Activity No.	Description
1	Innovation Exploration and Design Thinking Orientation	Study successful innovations from industry, identify user problems solved, discuss Design Thinking stages and submit reflection.
2	Observation and Need Finding	Visit campus/community, observe users, record difficulties through notes or photographs and videos.
3	User Interview and Stakeholder Analysis	Conduct structured interviews with at least 5–10 users and identify stakeholders affected by the problem.
4	Empathy Mapping Workshop	Create Empathy Maps (Think-Feel-Say-Do) and understand user emotions, needs and expectations.
5	Customer Journey Mapping	Map the complete user experience and identify pain points, bottlenecks and opportunities.
6	Problem Definition and Need Statement	Convert observations into "How Might We" Statements and define measurable problem statements.
7	Root Cause Analysis	Perform Fishbone Diagram and 5-Why Analysis to identify actual causes behind the problem.
8	Brainstorming and Idea Generation	Generate a minimum of 25 ideas using brainstorming and brain writing techniques.
9	Creative Thinking using SCAMPER and Six Thinking Hats	Apply creativity tools to improve existing ideas and explore alternative solutions.

Sr No	Activity No.	Description
10	Concept Screening and Decision Matrix	Evaluate ideas based on feasibility, cost, innovation, sustainability and impact using a decision matrix.
11	Storyboarding and User Scenario Design	Develop visual storyboards explaining how users interact with the proposed solution.
12	Low-Fidelity Prototype Development	Develop sketches, paper models, mockups and wireframes representing the solution.
13	Physical/Digital Prototype Development	Build a working prototype using physical materials, CAD tools, app interfaces or simulation software.
14	User Testing and Validation	Conduct user testing, collect feedback, identify usability issues and document observations.
15	Design Improvement, Business Pitch and Final Demonstration	Refine the solution, prepare value proposition/business model and present final prototype with project report.

Text Books

1. Change by Design, Tim Brown, Change by Design: How Design Thinking Creates New Alternatives for Business and Society, Harper Business.
2. Design Thinking for Strategic Innovation, Idris Mootee, Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School, Wiley Publications.
3. The Design Thinking Playbook, Michael Lewrick, Patrick Link and Larry Leifer, The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems, Wiley.

Reference Books

1. Designing for Growth, Jeanne Liedtka and Tim Ogilvie, Designing for Growth: A Design Thinking Tool Kit for Managers, Columbia University Press.
2. Creative Confidence, David Kelley and Tom Kelley, Creative Confidence: Unleashing the Creative Potential Within Us All, Crown Business.
3. Design Thinking, Nigel Cross, Design Thinking: Understanding How Designers Think and Work, Bloomsbury Publications.
4. Universal Methods of Design, Bella Martin and Bruce Hanington, Universal Methods of Design, Rockport Publishers.
5. Design Thinking Research, Hasso Plattner, Christoph Meinel and Larry Leifer, *Design Thinking Research*, Springer.

CO-PO Matrix

Course Outcome	Programme Outcome (PO)/ Programme Specific Outcome(PSO)												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	-	1	-	1	-	2	2	-	1		
CO2	1	3	2	2	-	1	-	2	2	-	1		
CO3	1	3	3	1	-		-	2	2	-	1		
CO4	1	2	3	3	2	-	-	2	2	1	1		
CO5		1	2	1	1	1	1	3	3	3	1		

Rayat Shikshan Sanstha's
Karmaveer Bhaurao Patil College of Engineering, Satara
An Autonomous Institute

Department of Basic Sciences & Humanities Engineering

Course: F. Y.	Semester: I & II	L	T	P	Credits
Course Code: 26BSHA209A / 26BSHB109A	Course Name: Indian Knowledge System In Architecture And Town Planning	2	–	–	2

Course Objective:

1. Students would be introduced to the glorious past and achievements of the Indian subcontinent ranging from the "ancient period" to the "medieval period" concerning architecture and town planning.
2. To develop a sense of pride and belongingness amongst the students towards Indian Knowledge Systems and further motivate them to bridge the gap between knowledge and application.
3. To understand the nuances of site location, design, layout, architectural elements and planning of residences, temple architecture, forts, town and city planning.

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

1. The course is devised to acquaint the students with the vast expanse of knowledge on Vastu Vidya and Vastu Shastra.
2. Students would be introduced to ancient Indian scriptures on Architecture and Planning; emple architecture styles and Town Planning in ancient India.

Unit No.	Description	Hrs.
1	Module 1: Introduction and Fundamental Concepts □ Concept of space in Indian Art and Architecture	
2	Module 2: Temple Architecture □ Historical timeline for dynasty mapping and their important architectural and planning developments. □ Evolution of temple architecture from rock-cut to isolated to structural temples □ Temple construction and style: Nagara, Vesara and Dravida □ Ancient Indian treatise on Temple Architecture □ Iconography in Temples	
3	Module 3: Irrigation and Water Management System □ Irrigation and Water Management System in Ancient India	
4	Module 4: Town Planning □ Ancient Indian Town Planning with reference to Indus Valley Civilization □ Classification of towns according to Manasara □ Town Planning as per cosmic orientation □ Planning of temple towns and sacred geometry of ancient cities	

References:

1. Mayamatam : Treatise of Housing Architecture and Iconography by Bruno Dagens
2. Architecture of Manasara by Prasanna Kumar Acharya
3. Encyclopaedia of Indian Temple Architecture by Michael W. Meister (Editor), M. A. Dhaky
4. Theory and Practice of Temple Architecture in Medieval India by Adam Hardy
5. The Hindu Temple: An Introduction to Its Meaning and Forms by George Michell
6. Rediscovering the Hindu Temple: The Sacred Architecture and Urbanism of India by Vinayak Bharne and Krupali Krusche
7. Elements of India

Course: F. Y.	Semester: I & II	L	T	P	Credits
Course Code: 26BSHA209B / 26BSHB109B	Course Name: Indian Ethics	2	–	–	2

Course Objective:

- This course is very important in many senses. One, it will cultivate an idea of Indian Ethics in the students. Second, it will throw some light on that traditional knowledge which is ignored but highly important for Individuals and the State as well. Third, it will aware to the students and others of our holistic approach to Ethics and Value from the Cosmic level to Social and Political policy.
- There is already a course on Ethics and Value running to the students but that is far beyond from Indian Niti concept. This course will create holistic awareness among the students about Indian Ethics.

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

- Ethics as a discipline deals with concepts such as „ought" „right" „good" „virtue" and „duty" and the principles that define them and make them universally applicable through the ages. When it comes to public policy one tends to expound these concepts in the context of welfare, development, and growth. While Western philosophy approaches these concepts from several different theories. In Indianphilosophy, the concept of Dharma encompasses all the above and thus allows for Dharma to be nonnegotiable while the principles may change from one situation to another. Indian Ethics gives various theories for the moral self-development of the individual.

Unit No.	Description	Hrs.
1	Unit I: Definition and Foundation of Nitishastra 1. Definition of Nitishastra and the difference between Niti and Western morality 2. Dharma and Niti 3. Ethics of Vedas: Ṛta and Ṛṇa, Yajña 4. Ethics of Upanisads: Śreyah, Preyah, Nišreyah 5. Purusartha Chatushtaya: Dharma, Artha, Kama and Moksha.	
2	Unit II: Individual Ethics: 1. Svabhāva, Svadharma, Sthitaprajña 2. Highest Goal; Synthesis of Karma, Jñāna and Bhakti Marga. 3. Niskāma Karma Yoga and Lokasamgraha 4. Law of Karma.	

3	Unit III: Important Thinkers and Their Important Niti for Society 1. Brihaspati 2. Shukra 3. Kautilya 4. Kamandak 5. Bhishma Niti 6. Vidur Niti 7. Yudhisthir Niti 8. Bhrtrihari"s Niti 9. Nit-tatva in Manusmriti 10. Panch Tantra and Hitopdesh	
4	Unit IV: Dandaniti- State, Society, and Dharma 1. Rajneeti in Nitishastras 2. Rajneeti and Dharma 3. Rajneeti and Society 4. Qualities and Character of King 5. Danda-Vidhan in different crimes 6. Taxation in Nitishastras. 7. Sam, Dan, danda, Bhed: Four upayas and essential gunas. 8. Secret Police: appointment, Division, and duties. 9. Appointment of Ministers, ambassador, and other royal officials and their work. 10. War-related ethics in Scriptures.	

References:

1. Sitaram Jayaram Joshi. 1933. Niti Manjari of Dya Dviveda. Saligram Sharma, Banaras.
2. Khemraj Shrikrishnadas. 1961. Kamndakiyanitisarh. Mumbai
3. Prof. Sriyut Prannath Vidyalankar. 1923. Kautilya Arthshstra, Lahore.
4. Bimal Krishna Matilal (Editor). 1992. Moral Dilemmas in the Mahabharata. Indian Institute of
Advance Study, Shimla.
5. R. Samashastri. 1999. Kautilya"s Arthshastra. Parimal Publication Delhi.
6. Ganapati Sastri. 1920. Kamndaka"s Nitisar. Trivandrum Sanskrit Series. Kerala.
7. Madhvacharya"s. 1900. Parasar Smriti. Trivandrum Sanskrit Series. Kerala.
8. Aiyangar, K.V. Rangaswamy. 1916. Some Aspect of Ancient Indian Polity. Madras.
9. Veda Vyas, Shri. Vidura Niti.2018. Chaukhamba Sanskrit Sirij, Varanasi.
10. Bhartrihari. Nitishatakam. 2021. Chaukhamba Surbharati Prakasha

Course: F. Y.	Semester: I & II	L	T	P	Credits
Course Code: 26BSHA209C / 26BSHB109C	Course Name: Indian Astronomy	2	–	–	2

INDIAN ASTRONOMY

Course Objective:

1. To equip the introductory knowledge of Indian astronomy from the time of the Rig-Veda all the way till the pre-modern period.

2. Participants will also be able to understand how our ancient scientists forecast eclipses and position of planets.

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

The study of astronomy in our culture has deep roots and provides scientific explanations for various phenomena. As it broadens their view and comprehension of the world, it is crucial to teach the younger generation about the cosmos and how it functions. Students via this course will develop a broader understanding of various viewpoints about how different cultures have observed the universe and the tools discovered for its understanding. Indian Astronomy course will also bring students closer to our culture and foster critical thinking by combining scientific and metaphysical approaches, fostering creativity and connecting subjects like mathematics, physics, and chemistry in practical ways. This course will help student to discern the facts and bust the conceptions about the beginnings of the life and universe. The course will provide ample scope to students for their own discoveries and novel scientific improvements.

SYLLABUS

1) Preliminaries of Indian Astronomy

2) Developments from the Vedic period up to the Siddhāntic period

3) Indian Calendar

4) Solar and Lunar Eclipses

5) Tripraśna Topics (Diurnal problems)

6) Planetary longitudes and latitudes and Nīlakaṇṭha Somayājī"s revised planetary model

7) Rates of motion of planets

8) Tripraśna

9) Rising times of Rāśis and finding Lagna

10) Eclipse calculations

11) The Vākya system

References:

1. S. N. Sen and K. S. Shukla, History of Astronomy in India, 2nd Ed., INSA, Delhi, 2001.

2. S. Balachandra Rao, Indian Astronomy An Introduction, Universities Press, Hyderabad, 2000

3. History of Astronomy: A Handbook, Edited by K. Ramasubramanian, Aniket Sule and Mayank Vahia, SandHI, IIT Bombay, and T.I.F.R. Mumbai, 2016.

4. B.V. Subbarayappa and K.V. Sarma, Indian Astronomy: A Source Book, Nehru Centre, Bombay, 1985.

5. Tantrasaṅgraha of Nīlakaṇṭha Somayājī, Translation and Notes, K. Ramasubramanian and M. S. Sriram, Hindustan Book Agency, New Delhi, 2011

6. Karaṇapaddhati of Putumana Somayājī, Venketeswara Pai et al., HBA New Delhi and Springer 2018

Course: F. Y.	Semester: I & II	L	T	P	Credits
Course Code: 26BSHA210A/ 26BSHB110A	Course Name: Integrated Personality Development	-	–	2	1

Course Outcomes:

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

CO1. To provide students with soft skills that complement their hard skills, making them more marketable when entering the workforce.

CO2. To enhance awareness of India's glory and global values, and to create considerate citizens who strive for the betterment of their family, college, workforce, and nation.

CO3. To inspire students to strive for a higher sense of character by learning from role models who have lived principled, disciplined, and value-based lives.

List of Practicals

(Perform any 10)

1. Understanding the concepts – Pleasing Personality & Positive Attitude.
2. Realization of 'Self' through SWOT Analysis.
3. Building 'Self Esteem' & Self Confidence.
4. Learning effective Communication Skills, Positive Body Language & Developing English Proficiency.
5. Developing Public Speaking Skills.
6. Learning Presentation Skills.
7. Understanding Business Communication: The art of Cold Emailing.
8. Understanding the importance of 'Goal Setting' & structure it through SMART Goal.
9. Understanding the necessity & importance of Time Management.
10. Learning 'Team spirit & harmony' that is essential for students' profession
11. & personal life.
12. Exploring new approach to leadership through humility.
13. Learning to cope with current & future causes of stress. 13.
14. Identifying & overcoming the anger issues of self through Anger Management.
15. Learning about Conflict Management.

COURSE MATERIAL / MAIN COURSE WORKBOOK –

There will be one workbook for each semester. Each workbook will be Presented and designed by BAPS IPDC Team. These official workbooks would be the course-material for study of IPDC.

These workbooks will solve the purpose of study, submission and viva for students.

1. IPDC Workbook-2 (presented by B.A.P.S. Swaminarayan Sanstha)
2. Personality development & soft Skills {3rd Edition} –Barun K Mitra & Basundhara Mitra –Oxford University Press
3. Life Skills for Success –Alka Wadkar Sage

Course: F. Y.	Semester: I & II	L	T	P	Credits
Course Code: 26BSHA210B/26BSHB110B	Course Name: Health and Wellness	-	–	2	1

Course Objective:

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:

After completion of this course, 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.

List of Practicals- *Perform any 10*

1. **Happiness Self-Assessment** – Assess and reflect on your current level of happiness.
2. **Factors Affecting Happiness** – Identify personal, social and socio-economic factors influencing happiness.
3. **Positive Emotions Diary** – Record and analyze positive emotions experienced during a week.
4. **Gratitude Journal** – Maintain a daily record of things for which you are grateful.
5. **Three Good Things Activity** – Record three positive experiences each day and reflect on them.
6. **Acts of Kindness** – Perform and document simple acts of kindness toward others.
7. **Positive Thinking Exercise** – Identify negative thoughts and replace them with positive alternatives.

8. **Overthinking Management** – Identify causes of overthinking and practice techniques to manage it.
9. **Social Comparison Awareness** – Analyze the effects of comparing yourself with others.
10. **Signature Strengths Identification** – Identify and document your key personal strengths.
11. **Strengths in Action** – Apply one personal strength in an academic or social activity.
12. **Flow Experience Activity** – Identify activities that create deep involvement and a sense of flow.
13. **Self-Determination Activity** – Set goals based on autonomy, competence and relatedness.
14. **Eudaimonic Well-being Reflection** – Reflect on purpose, meaning, personal growth and well-being.
15. **Sustainable Happiness Plan** – Prepare a personal plan incorporating activities that promote long-term happiness.

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.

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Department of Basic Sciences & Humanities Engineering

Course: F. Y.	Semester: I & II	L	T	P	Credits
Course Code: 26BSHA210C/26BSHB110C	Course Name: Social Outreach Activities	-	–	2	1

Course Objective:

To provide students with experiential learning opportunities through community engagement and social outreach activities, enabling them to develop social responsibility, teamwork, communication, leadership, empathy, environmental awareness and problem-solving skills

Course Outcomes:

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

CO1 Identify social, environmental and community-related issues through participation in outreach activities.

CO2 Demonstrate teamwork, communication, leadership and interpersonal skills while working with community members and peers.

CO3 Apply acquired knowledge and skills to address simple community needs through appropriate outreach activities.

CO4 Participate responsibly in activities related to social awareness, environmental sustainability, health, education and community development.

List of Practicals

Perform any 10 activities

1. **Tree Plantation and Maintenance Drive**
   - Plantation of saplings and monitoring their growth.
2. **Campus and Public Area Cleanliness Campaign**
   - Participation in Swachh Bharat Abhiyan activities.
3. **Water & Soil Conservation Awareness Program**
   - Survey and awareness regarding rainwater harvesting and water saving practices.
4. **Energy Conservation**
   - Assessment of electricity consumption in homes or institutions and suggesting energy-saving measures.
5. **Plastic-Free Campus/Village Campaign**
   - Awareness and collection drive to reduce single-use plastics.
6. **Blood Donation Awareness Program**
   - Organizing or participating in awareness campaigns on blood donation.

7. **Health and Hygiene Awareness Activity**
   - Conducting awareness sessions on personal hygiene, nutrition, and sanitation.
8. **Digital Literacy Program**
   - Training school students, senior citizens, or community members in basic computer and digital skills.
9. **Literacy and Educational Support Activity**
   - Teaching basic mathematics, science, or language skills to underprivileged students.
10. **Survey on Social Issues**
    - Conducting surveys related to education, health, environment, or social welfare and preparing a report.
11. **Road Safety and Traffic Awareness Campaign**
    - Creating awareness regarding traffic rules and safe driving practices.
12. **Solid, Liquid & E-Waste Collection and Management Drive**
    - Collection and segregation of electronic waste and promoting responsible disposal.
13. **Awareness Program on Sustainable Development Goals (SDGs)**
    - Activities promoting environmental sustainability and social responsibility.
14. **Community Development Activity**
    - Participation in community service activities such as cleanliness, education, or health initiatives
15. **Awareness Program on Cyber Security and Digital Safety**
    - Educating community members about online frauds, cyber security, and safe internet practices.

Reference-

- **A. P. Maheshwari**, Social Work and Community Development, New Delhi.
- **M. K. Gandhi**, Constructive Programme: Its Meaning and Place, Navajivan Publishing House, Ahmedabad.
- **M. K. Gandhi**, My Experiments with Truth: An Autobiography, Navajivan Publishing House, Ahmedabad.
- **S. R. Myneni**, Social Work and Social Welfare, Allahabad Law Agency.
- **S. C. Dubey**, Indian Society, National Book Trust, New Delhi.
- **Ram Ahuja**, Indian Social System, Rawat Publications, Jaipur.
- **A. R. Desai**, Rural Sociology in India, Popular Prakashan, Mumbai.

Web Resources

- **National Education Policy 2020:** Ministry of Education, Government of India.
- **NSS Portal:** National Service Scheme, Ministry of Youth Affairs & Sports.
- **UN Sustainable Development Goals:** United Nations.
- **UNESCO Education for Sustainable Development:** UNESCO.