



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Branch: Electrical Engineering

Subject Code: BE100501

Subject Name : Contributor

Personality Development Program

w. e. f. Academic Year:	2024-25
Semester:	5TH
Category of the Course:	PD(elective)

Prerequisite:	Personality development (elective)
Rationale:	This course is designed to transform the mindset of students from being just “workers” to becoming “contributors.” In today’s dynamic work environment, organizations seek individuals who go beyond task execution — those who take initiative, create value, and demonstrate ownership.

Teaching and Examination Scheme –

Hours per Week			Course Credits	Examination Marks				
L	T	P		Theory Marks		Practical Marks		Total Marks
				E	M	I	V	
2	0	0	2	60	40	20	30	150

Detailed Syllabus –

Unit	Content	Total Hrs	% Of Weight
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Personality Development Program

1	The Contributor Work Ideal: In this topic, students explore what is their “ideal” of work – is the ideal to be a “worker” or to be a “contributor”? For example, an employee who has the ideal of a “worker” goes to work to pass time, earn a living, get benefits; in contrast to an employee with the ideal of a “contributor” who wants to make a difference, get things done well, create value for the company. This enables students to transform their expectation of themselves in work	7	16.7%
2	Identity & Self-esteem: In this topic, students engage with the question “who am I?” or on what basis do they define themselves. Is their identity defined by what others think of them (extrinsic self-esteem) or by what they think of themselves (intrinsic self-esteem)? Further, they discover positive identities that lead to intrinsic self-esteem, such as an I-can identity based on one’s capacity and inner strength. This enables them to build confidence and self-esteem.	7	16.7%



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3	<p>Become a Creator of one's destiny: In a "victim stance", we see the career environment as full of difficulties and hurdles. We feel powerless or blame our circumstances for not having many opportunities. This makes us fearful of uncertainty and makes us settle for jobs where we remain mediocre. In this topic, students discover the "creator of destiny stance" to challenges and situations. This stance frees them to try out new things, open up new possibilities, take on responsibility, see the opportunity hidden in their environment.</p>	7	16.7%
4	<p>Achieving Sustainable Success: In this topic, students discover how to achieve sustainable or lasting success, by building one's "engine of success", making them success worthy. Where their focus shifts to building one's "engine of success" Rather than being on chasing the "fruit of success". This is important, because over a lifetime of work, all people go through ups and downs – where the fruits are not in their control. People who are focused on the fruit of success, fall prey to disappointment, losing motivation, quitting too early, trying to find shortcuts – when fruits don't come. Whereas people focused on building their engine of success continue to contribute steadily, irrespective of whether fruits come or not. And with a strong engine of success, fruits come to them in time.</p>	7	16.7%



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5	Career Development Models: In this topic, students explore arrange of diverse “career development models” and the possibilities for contribution each opens up to them (e.g. start-up career model, change-maker career model, etc.). This opens their mind to different and even unconventional career models possible, beyond the usual (such as “stable large company career model” where one gets an engineering degree, then MBA, then get a job in a large company). This frees them from a herd mentality when making career choices.	7	16.7%
6	Expanding contribution in every role: In this topic, students explore the many roles they can play in their life & discover the power they have to expand the contribution possible in any role. (E.g. role of student, role of manager, role of a project site engineer). So, the potential of a role is in the individual’s hands. This opens their mind to an alternative way of career growth.	7	16.7%
Teaching hours		42	100

Course Outcomes –

CO No.	Course Outcome	RBT Level
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CO1	Recognize and appreciate two alternative ideals of work – “worker” vs “contributor”	Understand
CO2	Recognize and appreciate positive identities for building intrinsic self-esteem	Understand, Apply
CO3	Distinguish between “victim” stance and “creator of destiny” stance in facing challenges	Analyze, Evaluate
CO4	Differentiate between ‘building engine of success’ vs ‘chasing fruits of success’ for sustainable growth	Analyze
CO5	Explore and appreciate diverse career development models	Understand, Apply
CO6	Expand the contribution possible in any role and interpret experiences in terms of contribution	Apply, Evaluate

CO\PO MATRIX

CO \ PO	CO1	CO2	CO3	CO4	CO5	CO6
PO1 Basic knowledge	2	1	2	2	2	2
PO2 Discipline knowledge	-	-	2	2	-	2
PO3 Experiments and practice	-	-	-	1	-	1
PO4 Engineering tools	-	-	-	-	-	-
PO5 The engineer and society	-	-	-	-	-	-
PO6 Environment and sustainability	3	2	3	2	1	2
PO7 Ethics	-	-	-	-	-	-
PO8 Individual and team work	3	3	2	2	2	2
PO9 Communication	2	2	2	2	2	3
PO10 Life-long learning	2	2	2	2	2	3



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CO\PSO	PSO1(Ability to develop self-awareness and professional conduct)	PSO2(Ability to demonstrate leadership and team contribution in real-world roles)
CO1	3	2
CO2	3	2
CO3	3	3
CO4	3	3
CO5	2	3
CO6	3	3

Reference book-

Basic reference for both students and teachers

- Contributor Personality Program text book cum work book developed by Illumine
- Web-based Activ Guide™ for self-exploration of rich media resources to vividly understand many of the ideas, watch role models, learn from industry people, get reference readings – that help them enrich the understanding they gained in the class published by Illumine Foundation

Advanced reference for teachers

- On Contributors, Srinivas V.;Illumine Ideas, 2011
- Enlightened Citizenship and Democracy; Swami Rangan at hananda, Bharatiya Vidya Bhavan, 1989
- Eternal Values for a Changing Society – Vol I-IV, Swami Rangan at hananda; Bharatiya Vidya Bhavan
- Karma Yoga,Swami Vivekananda;Advaita Ashrama
- Vivekananda:His Call to the Nation ,Swami Vivekananda; Advaita Ashrama
- Six Pillars of Self Esteem, Nathaniel Branden ;Bantam, 1995
- Mindset:TheNewPsychologyofSuccess,CarolS.Dweck;RandomHousePublishingGroup, 2007
- Lasting Contribution:How to Think ,Plan ,and Actto Accomplish Meaningful Work, Tad



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Waddington; Agate Publishing, 2007

- Why not?: how to use everyday ingenuity to solve problems big and small, Barry Nalebuff, Ian Ayres; Harvard Business School Press, 2003
- Thevaluemindset:returningtothefirstprinciplesofcapitalistenterprise(Ch8&9);Erik Stern, Mike Hutchinson; John Wiley and Sons, 2004
- The Power of Full Engagement: Managing Energy, Not Time, is the Key to High Performance and Personal Renewal, Jim Loehr, Tony Schwartz; Simon and Schuster, 2003
- CreatingSharedValue,MichaelE.PorterandMarkR.Kramer;HarvardBusinessReview; Jan/Feb2011, Vol. 89 Issue ½
- TheSpeedofTrust:TheOneThingThatChangesEverything,StephenM.R.Covey,Rebecca R.Merrill,StephenR.Covey;FreePress,2008
- TheCouragetomeetthedemandsofReality,HenryCloud;HarperCollins,2009
- Responsibilityatwork:howleadingprofessionalsact(ordon'tact)responsibly,HowardGardner ; John Wiley & Sons, 2007



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: UG

Branch: Electrical Engineering

Subject Code: BE100502

**Subject Name : IPDC-1(Integrated
Personality Development Course)**

w. e. f. Academic Year:	2025-26
Semester:	5TH
Category of the Course:	Personality development (elective)

Prerequisite:	Personality development (elective)
Rationale:	The Integrated Personality Development Course (IPDC-1) is designed to help students develop a holistic, value-based personality that supports success in academic, professional, and personal life. The course nurtures self-awareness, positive habits, ethical thinking, emotional intelligence, communication skills, and national pride. It introduces students to the lives of great personalities and emphasizes applying values such as empathy, unity, responsibility, and discipline. It also helps bridge the gap between soft skills and technical skills, producing ethically sound, socially responsible, and emotionally stable professionals.

Teaching and Examination Scheme –

Hours per Week			Course Credits	Examination Marks				
L	T	P		Theory Marks		Practical Marks		Total Marks
				E	M	I	V	
2	0	0	2	60	40	20	30	150



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Branch: Electrical Engineering

Subject Code: BE100502

Subject Name : IPDC-1(Integrated Personality Development Course)

Detailed Syllabus –

Lecture No.	Module-Lecture	Lecture Description	Hours	% Of Weight
1	Remaking Yourself Restructuring Yourself	Students learn how self-improvement enables them to secure a bright future for themselves. They will learn 6 powerful thought-processes that can develop their intellectual, physical, emotional, and spiritual quotients.	2	6
2	Remaking Yourself- Power of Habit	Students will undergo a study of how habits work, the habits of successful professionals, and the practical techniques that can be used to develop good habits in their life.	2	6
3	Learning from Legends- Tendulkar & Tata	Students will learn from the inspiration allives of India's two legends, Sachin Tendulkar and RatanTata. They will implement these lessons through relatable case studies.	2	6
4	From House to Home- Listening & Understanding	Active listening is an essential part of academic progress and communications. Students will learn to listen with their eyes, ears, mind, and heart.	2	6
5	Facing Failures- Welcoming Challenges	This lecture enables students to revisit the way in which they b approach challenges. Through the study of successful figures such as Disney, Lincolnand Bachchan, students will earn to face difficulties through a positive perspective.	2	6
6	Facing Failures- Significance of Failures	Failure is a student's daily source of fear, negativity, and depression. Students will be given the constructive skills to understand failure as formative learning experiences.	2	6
7	My India My Pride- Glorious Past-Part1	India's ancient Rishis, scholars, and intellectuals have made tremendous contributions to the world, they developed an advanced, sophisticated culture and civilization which began thousands of years ago. Students will learn the importance of studying India's glorious past so that they could develop a strong passion and pride for our nation.	2	8



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8	My India My Pride-Glorious Past-Part 2	Our ancient concepts can be used to seek revolutionary ideas and to generate inspiration. Students will develop a deeper interest in India's Glorious Past – by appreciating the need to read about it, research it, write about it, and share it.	2	6
9	Learning from Legends-A.P.J. Abdul Kalam	Dr Kalam's inspirational life displayed legendary qualities which apply to students (1) Dare to Dream (2) Work Hard (3) Get Good Guidance (4) Humility (5) Use Your Talents for the Benefit of Others.	2	6
10	Soft Skills-Networking & Leadership	Students are taught the means of building a professional network and developing a leadership attitude.	2	6
11	Soft Skills-Project Management	Students will learn the secrets of project management through the Akshardham case study. They will then practice these skills through an activity relevant to student life.	2	8
12	Remaking Yourself-Handling Social Media	Students will learn how social media can become addictive and they will imbibe simple methods to take back control.	2	6
13	Facing Failures-Power of Faith	Students will learn about the power and necessity of faith in our daily lives.	2	6
14	From House to Home-Bonding the Family	Students will understand the importance of strong family relationships. They will learn how to overcome the generation gap and connect with their family more.	2	6
15	Selfless Service-Seva	Students will learn that performing sevas is beneficial to one's health, wellbeing, and happiness. It also benefits and inspires others.	2	5
Teaching Hours			30	100



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**Subject Name : IPDC-1(Integrated
Personality Development Course)**

Course Outcomes –

CO No	Course Outcome Description	RBT Level
CO1	To provide students with a holistic value-based education that will enable them to be successful in their academic, professional, and social lives.	Remember
CO2	To give the students the tools to develop effective habits, promote personal growth, and improve their wellbeing, stability, and productivity.	Understand
CO3	To allow students to establish a stronger connection with their family through critical thinking and development of qualities such as unity, forgiveness, empathy, and effective communication.	Understand
CO4	To provide students with soft skills that complement their hard skills, making them more marketable when entering the workforce.	Apply
CO5	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.	Apply
CO6	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.	Evaluate

CO\PO MATRIX

CO \ PO	CO1	CO2	CO3	CO4	CO5	CO6
PO1 Basic knowledge	2	2			1	
PO2 Discipline knowledge	2	2	1	2		
PO3 Experiments and practice						
PO4 Engineering tools				2		
PO5 The engineer and society	-	-	-	-	-	
PO6 Environment and sustainability	-	-	-	-	3	



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PO7 Ethics	2	2	3	2	2	3
PO8 Individual and team work	-	-	2	3	-	2
PO9 Communication	-	-	2	2		
PO10 Life-long learning	3	3	2	3	2	2

CO\PSO MATRIX

CO \ PSO	PSO1(Apply the concepts of value-based education to build an ethically and emotionally balanced personality.)	PSO2(Use self-discipline, communication, and leadership traits to become a contributor in society and workplace.
CO1	3	2
CO2	3	2
CO3	3	3
CO4	2	3
CO5	3	2
CO6	3	3

Reference book-

Module No.	Module	References
1	Facing Failures	<ol style="list-style-type: none"> 1. Thomas Edison's factory burns down, New York Times Archives, Page 1, 10/12/1914 2. Lincoln Financial Foundation , Abraham Lincoln's "Failures": Critiques , Forgotten Books, 2017 3. J.K. Rowling Harvard Commencement Speech Harvard University Commencement, 2008 4. Born A gain on the Mountain: A Story of Losing Everything and Finding It Back, Arunima Sinha, Penguin, 2014 5. Failing Forward: Turning Mistakes Into Stepping Stones for Success, John C. Maxwell, Thomas Nelson, 2007 6. Steve Jobs: The Exclusive Biography Paperback, Walter Isaacson, Abacus, 2015



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		7. Failing Forward: Turning Mistakes Into Stepping Stones for Success, John C. Maxwell, Thomas Nelson, 2007
2	Learning from Legends	<p>8. Chase Your Dreams: My Auto biography, Sachin Tendulkar, Hachette India, 2017</p> <p>9. Playing It My Way: My Autobiography, Sachin Tendulkar, Hodder & Stoughton, 2014</p> <p>10. The Wit and Wisdom of Ratan Tata, Ratan Tata, Hay House, 2018</p> <p>11. The Tata Group: From Torchbearer to Trailblazers, Shashank Shah, Penguin Portfolio, 2018</p> <p>12. The Leader Who Had No Title, Robin Sharma, Jaico Publishing House, 2010</p> <p>13. In the Joy of Others : A Life-Sketch of Pramukh Swami Maharaj, Mohanlal Patel and BAPSS adhus, Swaminarayan Aksharpath, 2013</p>
3	My India My Pride	<p>1. Rishis, Mystics, and Heroes of India, Sadhu Mukundcharandas, Swaminarayan Aksharpath, 2011</p> <p>2. Physics in Ancient India, Narayan Dongre, Shankar Nene, National Book Trust, 2016</p> <p>3. The Rise of Civilization in India and Pakistan, Raymond Allchin, Bridget Allchin, Cambridge University Press, 1982</p> <p>4. The Āryabhaṭīya of Āryabhaṭa: An Ancient Indian Work on Mathematics and Astronomy (1930), Walter Eugene Clark, University of Chicago Press, reprint, Kessinger Publishing, 2006</p>



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4	Remaking Yourself	<ol style="list-style-type: none"> 1. Power of Habit, Charles Duhigg, RandomHouseTradePaperbacks,2014 2. Change Your Habit, ChangeYourLife, TomCorley, NorthLoopBooks,2016 3. The Seven Habits of Highly Effective People, Stephen Covey, Simon & Schuster,2013 4. Seven Habits of Highly Effective Teens, Sean Covey, Simon & Schuster,2012 5. Atomic Habits, James Clear, Random House,2018 6. Howahandfuloftechcompaniescontrolbillionsofmindseveryday,TristanHarris,TED Talk, 2017
5	From House to Home	<ol style="list-style-type: none"> 1. “What Makes a Good Life? Lessons from the Longest Study on Happiness”, R.Waldinger, Ted Talks, 2015 2. Long Walk To Freedom, Nelson Mandela, Back Bay Books,1995 3. Outliers,MalcolmGladwell,BackBayBooks,2011
6	Soft Skills	<ol style="list-style-type: none"> 1. The 17 Indisputable Laws of Team work, John Maxwell, Harper Collins, 2013 2. Team of Teams: New Rules of Engagement for a Complex World, Stanley Mc Chrystal, Portfolio, 2015 3. PredictablyIrrational,RevisedandExpandedEdition:TheHiddenForcesTha tShapeOur Decisions, Dan Ariely, Harper Perennial, 2010
7	Selfless Service	<ol style="list-style-type: none"> 1. Open: An Autobiography, Andre Agassi, Vintage, 10August 2010 2. The Physiological Power of Altruism [online], James Hamblin, The Atlantic, December 30, 2015, https://www.theatlantic.com/health/archive/2015/12/altruism-for-a-better-body/422280/ [lastaccessedJune10,2020] 3. TBIB logs: From Entrepreneurs to Doorkeepers, Every body Serves with Love & Warmthat This Ahmadabad Café [online], The People Place Project, The Better India, May 29, 2017, https://www.thebetterindia.com/102551/small-way-serve-ahmedabad-seva-cafe/, [last accessed June10,2020]



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101501

Course/Subject Name: Heat Transfer

w.e.f. Academic Year:	2024-25
Semester:	5 th SEM / 3 rd year
Category of the Course:	Professional Core

Prerequisite:	Nil
Rationale:	The course is prepared to provide the detailed understating of various modes of heat transfer and its applications in Mechanical Engineering. The course also provides the basic technical knowledge related to heat exchangers.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA(M)	PA(I)	ESE(V)	
4	0	2	5	60	40	20	30	150



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101501

Course/Subject Name: Heat Transfer

CourseContent:

Unit No.	Content	No.of Hours	% of Weigh tage
1	Conduction: <ul style="list-style-type: none"> Fourier's law, effect of temperature on thermal conductivity of different solids, liquids and gases,generalized equation in Cartesian, cylindrical and spherical coordinates and its reduction to specific cases, One dimensional steady state conduction, heat conduction through plane and composite walls, cylinders and spheres, electrical analogy, critical radius of insulation for cylinder and sphere, overall heat transfer coefficient Heat transfer from extended surface: <ul style="list-style-type: none"> Types of fin, heat flow through uniform cross-sectional area fin for various cases like infinitely long fin, fin insulated at the tip and fin losing heat at the tip, efficiency and effectiveness of fin, Estimation of error in temperature measurement in a thermometer well Transient heat conduction: <ul style="list-style-type: none"> lumped capacitance method for bodies of infinite thermal conductivity, time constant, one dimensional transient heat conduction in plane wall with finite conduction and convective resistances 	18	30
2	Convection: <ul style="list-style-type: none"> Newton's law of cooling, dimensional analysis applied to forced and free convection, dimensionless numbers and their physical significance, empirical correlations for free and forced convection,Continuity, momentum and energy equations, thermal and hydrodynamic boundary layer, Blasius solution for laminar boundary layer, General solution for Von-Karman integral momentum equation 	12	20
3	Radiation: <ul style="list-style-type: none"> Absorptivity, reflectivity and transmissivity, black, white and grey body, emissive power, emissivity, Kirchhoff's law,Planck's law, Rayleigh-Jeans' law, Wien's law, Wien's displacement law, Stefan-Boltzmann law, intensity of radiation, radiation heat exchange between black bodies, shape factor, electrical analogy, radiation heat exchange between gray bodies, radiosity, irradiation, radiation shields 	12	20



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Course/Subject Name: Heat Transfer

4	Heat exchanger: <ul style="list-style-type: none"> • Classification, heat exchanger analysis, • LMTD for parallel and counter flow exchanger, condenser and evaporator, • overall heat transfer coefficient, fouling factor, • correction factors for multi pass arrangement, • effectiveness-NTU method for parallel and counter flow heat exchanger, introduction of heat pipe and compact heat exchanger 	08	15
5	Two-phase heat transfer: <ul style="list-style-type: none"> • Boiling of liquids, Pool boiling curve, modes of pool boiling, • correlation for pool boiling, condensation of vapor, • film wise and drop wise condensation, • condensation on flat surfaces and horizontal tubes 	06	15
	Total	56	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
18	28	14	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



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Program Name: Engineering

Level: UG

Course/ Subject Code: BE101501

Course/Subject Name: Heat Transfer

Course Outcome:

After Completion of the Course , the Student will be able to:

No	Course Outcomes	RBT level
CO1	To classify the heat transfer problems and to apply the principles of steady state one-dimensional heat transfer, extended surface, and unsteady conduction for Mechanical engineering problems.	Apply
CO2	To identify the type of convection problems and apply concepts of natural and forced convection for related problems.	Apply
CO3	To explain laws of radiation heat transfer and determine radiation heat transfer between black and grey surfaces.	Apply
CO4	To practice LMTD and effectiveness-NTU method for simple heat exchange devices.	Understand
CO5	To identify types of boiling and condensation heat transfer processes and estimate heat transfer coefficients.	Understand

Program Outcomes (POs)

PO No.	Program Outcome
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage

Course Outcome to Programme Outcome (CO-PO) Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	2
CO2	3	3	2	2	2
CO3	3	3	2	2	2
CO4	3	2	2	2	3
CO5	3	2	2	2	2



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Level: UG

Course/ Subject Code: BE101501

Course/Subject Name: Heat Transfer

Program Specific Outcomes (PSOs)

PSO No.	Program Specific Outcome
PSO1	Apply fundamental knowledge of mechanical engineering to solve thermal and fluid systems problems.
PSO2	Use engineering tools and techniques to design and analyze heat transfer components.

CO-PSO MAPPING:

CO \ PSO	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	2	3
CO5	3	3

References/Suggested Learning Resources:

(a) Books:

1. Heat and Mass Transfer by P.K. Nag, McGraw Hill
2. Heat and Mass Transfer: Fundamentals and Application by YunusCengel, McGraw Hill
3. Fundamental of Heat and Mass Transfer by Incropera and Dewitt, Wiley Publication
4. Heat Transfer by Mills and Ganesan, Pearson Education
5. Heat Transfer by J P Holman , McGraw Hill
6. Heat and Mass Transfer by R K Rajput, S.Chand Publication

(b) Open-sourcewebsite:

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

Suggested Course Practical List:

1. To determine the thermal conductivity of given metal rod
2. To determine the thermal conductivity of the given composite walls.
3. To determine Stephan Boltzmann constant experimentally.
4. To determine heat transfer co-efficient by forced convection.
5. To determine heat transfer co-efficient by natural convection.
6. To determine the overall heat transfer co-efficient of shell and tube type heat exchangers.
7. To determine the emissivity of gray body.



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Course/Subject Name: Heat Transfer

8. To study film and drop wise condensation and to determine the film co-efficient
9. To measure convective heat transfer co-efficient and effectiveness of the fin under forced convection.
10. To measure convective heat transfer co-efficient and effectiveness of the fin under natural convection.
11. To determine heat transfer co-efficient for hair pin heat exchanger.
12. To determine heat transfer co-efficient for transient heat transfer process.
13. To determine critical radius of insulation.

List of Laboratory/Learning Resources Required:

- Hair pin heat exchanger,
- Shell and tube heat exchanger,
- Pin fin apparatus,
- Emissivity measurement apparatus,
- Composite wall apparatus,
- Stefan Boltzmann apparatus,
- Natural and force convection apparatus,
- transient heat transfer apparatus,
- critical radius apparatus,
- film and drop wise condensation apparatus



SWAMINARAYAN UNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE101502

Course/Subject Name: DYNAMICS OF MACHINERY

w.e.f.Academic Year:	2024-25
Semester:	5 TH Semester/ 3 RD Year
Category of the Course:	Professional core

Prerequisite:	Kinematics and theory of machines
Rationale:	The course is designed to give fundamental knowledge of behavior of machines under dynamic condition

Teaching and Examination Scheme:

TeachingScheme(inHours)			TotalCredits L+T+(PR/2)	AssessmentPatternandMarks				TotalMark s
L	T	PR	C	Theory		Tutorial/Practical		
				(E)	(M)	(I)	(V)	
4	0	2	5	60	40	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Dynamic force analysis of mechanisms: Introduction, D'Alembert's principle, equivalent offset inertia force, dynamic analysis of four link mechanism, dynamic analysis of slider crank mechanism, velocity & acceleration of piston, angular velocity & angular acceleration of connecting rod, engine force analysis, dynamically equivalent system inertia of the connecting rod, inertia force in reciprocating engines. .	04	15
2.	Turning moment diagrams and flywheel Turning moment diagram for various type of engines, fluctuation of energy, fluctuation of speed, flywheel, energy stored in flywheel, dimensions of flywheel rims, flywheel in punching presses.	04	10
3.	Balancing: Introduction, static balancing, dynamic balancing, transference of force from one plane to another plane, balancing of several masses in different planes, force balancing of linkages, balancing of reciprocating mass, balancing of locomotives, Effects of partial balancing in locomotives, secondary balancing, balancing of inline engines, balancing of v-engines, balancing of radial engines, balancing machines	11	20



SWAMINARAYAN UNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE101502

Course/Subject Name: DYNAMICS OF MACHINERY

सर्व विद्या अधिपतये

4.	Gyroscope: Angular velocity, angular acceleration, gyroscopic torque, gyroscopic effect on naval ships, aero plane, stability of an automobile, stability of two wheel vehicle	05	10
5.	Free vibrations and damped free vibrations: Types of vibrations, elements constituting vibration, spring mass system, free undamped vibrations, equation of motion, equivalent spring stiffness, free damped vibrations, equation of motion for viscous damper, damping factor, under damped system, critically damped system, over damped system, logarithmic decrement, free torsional vibration of a two and three rotor system, torsionally equivalent shaft, torsional vibration of a geared system	12	20
6.	Forced damped vibrations: Analytical solution of forced damped vibration, vector representation of forced vibrations, Magnification factor, force transmissibility, forced vibration with rotating and reciprocating unbalance, forced vibration due to excitation of support, vibration frequency measurement	08	15
7.	Critical speeds of shafts: Critical speed of shaft carrying single rotor and having no damping, Critical speed of shaft carrying single rotor and having damping, secondary critical speeds in horizontal shafts, critical speed of shaft having multiple rotors. .	05	10
Total		49	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
22%	32%	46%	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Summarize dynamic forces and turning moments in mechanisms.	Understand,



SWAMINARAYAN UNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE101502

Course/Subject Name: DYNAMICS OF MACHINERY

सर्व विद्या अधिपतये

2	Minimize unbalance in mechanical systems by means of static and dynamic balancing	Apply / Analyze
3	Analyze gyroscopic effect in aeroplane, ships and automobiles.	Analyze
4	Demonstrate longitudinal vibrations, transverse vibrations and torsional vibrations in single degree of freedom systems .	Understand / Apply
5	Determine critical speed of the shaft.	Apply

Course Outcome to Programme Outcome (CO-PO) Mapping

CO-PO Mapping					
PO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1 Basic Engg Knowledge	3	3	3	3	2
PO-2 Problem Analysis	3	2	2	2	2
PO-3 Design/Development	2	2	2	3	2
PO-4 Investigations	2	2	1	2	1
PO-5 Modern Tool Usage	2	2	2	2	2
PO-6 Engineer & Society	0	0	0	0	0
PO-7 Environment & Sustainability	0	0	0	0	0
PO-8 Ethics	0	0	0	0	0
PO-9 Individual & Team Work	0	0	0	0	0
PO-10 Communication	1	1	1	1	1
PO-11 Project Management	1	0	0	1	0
PO-12 Lifelong Learning	1	1	1	1	1
CO-PSO Mapping					
PSO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5
PSO-1 Programming Skills	3	2	2	3	2
PSO-2 Analytical Ability	2	2	2	2	1
PSO-3 Software Tools Use	1	1	1	1	1



SWAMINARAYAN UNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE101502

Course/Subject Name: DYNAMICS OF MACHINERY

References/Suggested Learning Resources:

(a) Books:

1. Theory of Machines, S.S.Rattan , Tata Mc-Graw Hill.
2. Mechanical Vibrations and Noise Engineering, A. G. Ambekar, Prentice Hall of India.
3. Dynamics of Machinery, Farazdak Haideri, Nirali Prakashan.
4. Dynamics of Machines, S. Balaguru, Cengage Learning India Pvt. Ltd.
5. Kinematics and Dynamics of Machinery, Norton R L, McGraw-Hill
6. Theory of Machines : Kinematics and Dynamics, Sadhu Singh, Pearson

(b) Open source software and website:

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

Suggested Course Practical List:

1. Static and dynamic balancing of rotating masses.
2. Understanding of gyroscopic effect using motorized gyroscope.
3. Longitudinal free vibration of spring mass system.
4. Study of torsional vibration in shaft (single rotor and two rotor system)
5. Study of free damped vibration and logarithmic decrement.
6. Study of forced damped vibration.
7. Critical speed of the shaft.
8. Study of dynamic forces and turning moments in mechanisms.

List of Major Equipment/ Laboratory/Learning Resources/ Required:

- Two stroke and Four stroke Engines
- Cut section models for Fuel supply and lubrication systems
- Single plate, Multi-plate and Centrifugal clutch assemblies
- Cut section of Constant mesh, Sequential, Differential and CVT gearbox assemblies
- Cut section of Leaf springs, Telescopic suspension and Mono suspension system
- Single and double cradle frames, Engine based frame
- Layout of Electrical systems

Suggested Project List:



SWAMINARAYAN UNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE 101503

Course/Subject Name: Control Engineering

w.e.f. Academic Year:	2024-25
Semester:	5 TH Semester/ 3 RD Year
Category of the Course:	Open Elective - 1

Prerequisite:	Nil
Rationale:	develop comprehensive knowledge and understanding of classical and modern control theory, industrial automation, and systems analysis. Control engineering is a diverse and rapidly expanding discipline which has become increasingly important in a wide range of industries.

Teaching and Examination Scheme:

TeachingScheme(inHours)			TotalCredits L+T+(PR/2)	AssessmentPatternandMarks				TotalMark s
L	T	PR	C	Theory		Tutorial/Practical		
				(E)	(M)	(I)	(V)	
3	0	0	3	60	40	00	00	100

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Basic concepts of control system: Control System, Basic components of control system, classification of control system, Closed loop control versus open loop control, Servomechanism, Regulator and process control, Example of control system.	03	10
2.	Modelling of control systems: Transfer function and impulse response function, Procedure for determining the transfer function of a control system, Block diagram of system, signal flow graph representation of physical systems along with rules, properties, Automatic control system, Linearization of nonlinear mathematical model, mathematical modeling of Mechanical systems and Electrical systems, Mathematical modeling of pneumatic and hydraulic systems, Fluid systems and Thermal systems.	09	15
3.	Modelling in time domain and its response analysis: Standard test signals along with examples of their usage, Applying state space representation, converting transfer function to state space, converting state space to transfer function, diagonalisation of state matrix, solution of state equation, concepts of controllability and observability, Poles, Zeros, and	09	15



SWAMINARAYAN UNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE 101503

Course/Subject Name: Control Engineering

	System response, First order systems, Second order systems, Higher order systems, Transient response analysis, Routh's stability criterion, Effects of Integral and Derivative control, steady state errors of feedback control systems, Root Locus plot, Lead Compensation, Lag compensation, Lag-Lead compensation, Parallel Compensation.		
4.	Frequency response analysis: Bode diagram, Polar plots, Log Magnitude versus Phase plot, Nyquist stability criterion, Stability analysis, Relative stability analysis, closed loop frequency response of unity feedback system, experimental determination of transfer function, control system design by frequency response approach, Lead Compensation, Lag compensation, Lag-Lead compensation	08	15
5.	PID controllers Tuning PID controllers, Design PID controllers, Modification of PID control, Two degree of freedom control	04	15
6.	Hydraulic control system: Basic elements of hydraulic circuit, Principle used in hydraulic circuit, Sources of hydraulic power, Integral, Derivative, PD & PID controller with its transfer function, Comparison between hydraulic and electrical control system.	04	15
7.	Pneumatic control system: Basic elements of pneumatic circuit, Difference between pneumatic and hydraulic control systems, Force balance and force distance type controllers, Nozzle-flapper amplifier, PD, PI and PID control system along with its transfer function.	04	15
	Total	41	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
16%	24%	30%	20%	10%	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



SWAMINARAYAN UNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE 101503

Course/Subject Name: Control Engineering

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Summarized fundamentals of control systems and components of control systems.	Remembering (R) / Understanding (U)
2	Demonstrate the methodology for modelling mechanical, hydraulic and pneumatic systems for control.	Understanding (U) / Applying (A)
3	Develop the transfer functions, state space representation and block diagrams of physical systems for its control and stability.	Applying (A) / Analyzing (An)
4	Analyze time domain and frequency domain responses of mechanical systems.	Analyzing (An)
5	Make use of PID controllers for control of physical systems.	Applying (A)

Course Outcome to Programme Outcome (CO-PO) Mapping

CO-PO Mapping					
PO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1 Basic Engg Knowledge	3	3	3	3	2
PO-2 Problem Analysis	2	2	3	3	2
PO-3 Design/Development	1	2	2	2	2
PO-4 Investigations	2	2	2	3	2
PO-5 Modern Tool Usage	2	2	2	2	2
PO-6 Engineer & Society	0	0	0	0	0
PO-7 Environment & Sustainability	0	0	0	0	0
PO-8 Ethics	0	0	0	0	0
PO-9 Individual & Team Work	0	0	0	0	0
PO-10 Communication	1	1	1	1	1
PO-11 Project Management	0	0	1	1	1
PO-12 Lifelong Learning	1	1	1	1	1
CO-PSO Mapping					
PSO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5
PSO-1 Programming Skills	3	3	3	3	2
PSO-2 Analytical Ability	2	2	2	3	2
PSO-3 Software Tools Use	1	1	2	2	1



SWAMINARAYAN UNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE 101503

Course/Subject Name: Control Engineering

References/Suggested Learning Resources:

(a) Books:

1. Modern control theory, Katsuhiko Ogata, Pearson Education International, Fifth edition.
2. Control system engineering, Norman S Nise, John Wiley & Sons, Inc., Sixth edition
3. Control system engineering, S. K. Bhattacharya, Pearson India
4. Modern control systems, Richard C. Dorf, Robert H Bishop, Pearson Education International, Twelfth edition.
5. Automatic control systems, Farid Golnaraghi, Benjamin C Kuo, John Wiley & Sons, Inc., Ninth edition

(b) Open source software and website:

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

Suggested Course Practical List:

List of Major Equipment/ Laboratory/Learning Resources/ Required:

Computational facility.

Suggested Project List:



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101504

Course/Subject Name: Oil Hydraulics and Pneumatics

w.e.f. Academic Year:	2024-25
Semester:	5 th SEM / 3 rd year
Category of the Course:	Professional Core

Prerequisite:	Nil
Rationale:	Course gives idea about the basic system working on fluid power and compressed air. Also different valves related to hydraulic and pneumatic systems are discussed in syllabus. Subject is also useful for designing the various hydraulic and pneumatic circuits for various engineering applications.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA(M)	PA(I)	ESE(V)	
3	0	0	3	60	40	00	00	100



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101504

Course/Subject Name: Oil Hydraulics and Pneumatics

CourseContent:

Unit No.	Content	No.of Hours	% of Weigh tage
1	Introduction: <ul style="list-style-type: none"> Introduction, Global fluid power Scenario, Basic system of Hydraulics-Major advantages and disadvantages, Comparison among Electrical, Hydraulics and Pneumatics System, Principles of Hydraulic Fluid power, Hydraulic Symbols, Electrical Elements used in hydraulic circuits. Basic Requirements for Pneumatic System, Basic Symbols of Pneumatic Systems, Applications of Pneumatics. Electrical elements used in Pneumatic System. 	08	20
2	Hydraulic Oils, Fluid Properties and Filter: <ul style="list-style-type: none"> Types, Properties, physical characteristics & functions of hydraulic Oils, Classification Mineral based, Fire resistant& Biodegradable Oils, Filters, Contaminations, location of filter. 	06	15
3	Hydraulic Pumps, Motors,Valves and Actuators: <ul style="list-style-type: none"> Classification of hydraulic pumps, Gear Pumps, Vane Pumps, Piston Pumps, Axial piston pumps, Hydraulic motors, Direction control valves, Pressure control valves, Flow control valves, Non-return valves, Reservoirs, Accumulators, Heating & cooling devices, Hoses. Types of Hydraulic Actuators, Selection criterion of Actuators, Linear and Rotary Actuators, Hydrostatic Transmission Systems. 	10	20
4	Air Preparation and Service Unit: <ul style="list-style-type: none"> Types & Selection criteria for Air Compressors, Air receiver, Pipeline Layout, Air filter, Pressure regulator and Lubricator (FRL unit). 	05	10
5	Pneumatic Cylinders, Motors and Valves: <ul style="list-style-type: none"> Types of Pneumatic Cylinders & Air motors, Cushion assembly, mounting Arrangements, Pneumatic Direction control valves, Quick exhaust, Time delay Shuttle and Twin pressure valves. 	05	10
6	Circuit Design: <ul style="list-style-type: none"> Basic hydraulic circuits, Industrial hydraulic circuits, Power losses in flow control circuits, Basic pneumatic circuits, Development of single Actuator Circuits, Development of multiple Actuator Circuits, Cascade method for sequencing 	06	15



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101504

Course/Subject Name: Oil Hydraulics and Pneumatics

7	Automation and Simulation of Hydraulics and Pneumatics: <ul style="list-style-type: none"> • Introduction to Automation in hydraulic and Pneumatic Systems, • Case study of Automation using Hydraulics and pneumatics. • Introduction to software of hydraulic and Pneumatic system, • Circuit designing in software, Simulation in software, • Simulation with actual component using software like automation in industry 	04	10
	Teaching hours	45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
28	18	14	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101504

Course/Subject Name: Oil Hydraulics and Pneumatics

Course Outcome:

After Completion of the Course , the Student will be able to:

No	Course Outcomes	RBT level
CO1	Demonstrate components for hydraulic and pneumatic systems and their applications.	Apply
CO2	Interpret functions of different hydraulic and pneumatic valves and make use of them in circuit design.	Apply
CO3	Design and analyze hydraulic and pneumatic circuits for specific applications.	Understand
CO4	Compile and make use of automation in hydraulic and pneumatic systems.	Analyzing (An)

Program Outcomes (POs)

PO No.	Program Outcome
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage

Course Outcome to Programme Outcome (CO-PO) Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	1	0	0
CO2	3	3	2	0	0
CO3	3	3	3	2	2
CO4	3	2	3	2	3

Program Specific Outcomes (PSOs)

PSO No.	Program Specific Outcome
PSO1	Apply knowledge of hydraulics and pneumatics to design and maintain fluid power



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101504

Course/Subject Name: Oil Hydraulics and Pneumatics

	systems for mechanical applications.
PSO2	Use modern tools and simulation software to analyze and automate hydraulic and pneumatic systems.

CO-PSO MAPPING:

CO \ PSO	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	3
CO4	2	3

References/Suggested Learning Resources:

(a) Books:

1. Industrial Hydraulics by John Pippenger and Tyler Hicks, McGraw Hill.
2. Oil Hydraulic Systems, Principle and Maintenance by S R Majumdar, McGraw-Hill.
3. Fluid Power with Applications by Anthony Esposito, Pearson.
4. Fluid Power: Generation, Transmission and Control, Jagadeesha T., ThammaiahGowda, Wiley.
5. The Analysis & Design of Pneumatic Systems by B. W. Anderson, John Wiley.
6. Control of Fluid Power Analysis and Design by Mc Clay Donaldson, Ellis Horwood Ltd.
7. Hydraulic and Pneumatic Controls: Understanding made Easy, K.ShanmugaSundaram, S.Chand& Co Book publishers, New Delhi, 2006 (Reprint 2009)
8. Basic Pneumatic Systems, Principle and Maintenance by S R Majumdar, McGraw-Hill.

(b) Open-source website:

1. NPTEL
2. Simulation Software of Hydraulic Pneumatic system.

Suggested Course Practical List:

List of Laboratory/Learning Resources Required:



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101505

Course/Subject Name: Manufacturing Technology

w.e.f. Academic Year:	2024-25
Semester:	5 th SEM / 3 rd year
Category of the Course:	Professional Core

Prerequisite:	Nil
Rationale:	The Manufacturing Technology subject is designed to acquire theoretical and practical knowledge in foundry, metal forming, metal joining, manufacturing processes and plastic processing. The manufacturing program provides relevant industrial experience within the academic environment to apply theoretical and practical concepts to improve manufacturing processes and mechanical or manufacturing components.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA(M)	PA(I)	ESE(V)	
3	0	2	4	60	40	20	30	150



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101505

Course/Subject Name: Manufacturing Technology

CourseContent:

Unit No.	Content	No.of Hours	% of Weight age
1	Manufacturing Technology: <ul style="list-style-type: none"> Importance of manufacturing, economic and technological definition of manufacturing, Classification of manufacturing processes, Selection of Manufacturing process 	03	10
2	Foundry Technology: Patterns practices: <ul style="list-style-type: none"> Types of patterns, allowances and material used for patterns, moulding materials, moulding sands, Moulding sands; properties and sand testing; grain fineness; moisture content, claycontent and permeability test, core materials and core making, core print; core boxes, chaplets, gating system design. Moulding practices: Green, dry and loam sand moulding, pit and floor moulding; shell moulding; permanent moulding; carbon dioxide moulding. Casting practices: <ul style="list-style-type: none"> Fundamental of metal casting, Sand casting, Shell-Mould casting, Mold casting (plaster and ceramic), Investment casting, Vacuum casting, Permanent mould casting, Slush casting, Pressure casting, Die casting, Centrifugal casting, Continuous casting, Squeeze casting, Casting alloys, Casting defects, Design of casting, Gating system design, and riser design. Melting furnaces-rotary, Pit electric, Tilting and cupola. Metallurgical considerations in casting elements of gating system, and risers and their design. 	10	20
3	Metal Joining Processes: <ul style="list-style-type: none"> Principle of welding, soldering, Brazing and adhesive bonding. Classification of welding and allied processes. Gas welding and gas cutting, Principle, Oxyacetylene welding equipment, Oxy hydrogen welding. Flame cutting. Arc welding, Power sources and consumables, Gas welding and cutting, Processes and Equipment. Resistance welding, Principle and Equipment, Spot, Projection and seam welding process, Atomic hydrogen, ultrasonic, Plasma and laser beam welding, Electron beam welding, and 	10	20



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101505

Course/Subject Name: Manufacturing Technology

	<ul style="list-style-type: none"> special welding processes e.g. TIG, MIG, friction and explosive welding, welding of C.I. and Al, Welding defects. Electrodes and Electrode Coatings, Welding positions. 		
4	Forming and Shaping Processes: <ul style="list-style-type: none"> Metal working, Elastic and plastic deformation, Concept of strain hardening, Hot and cold Working, Rolling: Principle and operations, Roll pass sequence, Extrusion, Wire and tube drawing processes. Forging: Method of forging, Forging hammers and presses, Principle of forging tool design, Cold working processes: Shearing, Drawing, Squeezing, Blanking, Piercing, deep drawing, Coining and embossing, Metal working defects, cold heading, Riveting, Thread rolling bending and forming operation. 	10	20
5	Plastic Technology: <ul style="list-style-type: none"> Introduction, Classification of Plastics, Ingredients of Moulding compounds, General Properties of Plastics, Plastic part manufacturing processes such as compression moulding, Transfer moulding, Injection moulding, Extrusion moulding, Blow moulding, Calendaring, Thermo forming, slush moulding, laminating 	06	15
6	Advance Super finishing Technology: <ul style="list-style-type: none"> Introduction, Lapping, Honing, Buffing, Barrel Tumbling, Burnishing, Powder coating, Polishing. 	06	15
	Teaching hours	45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
28	18	14	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101505

Course/Subject Name: Manufacturing Technology

Course Outcome:

After Completion of the Course , the Student will be able to:

No	Course Outcomes	RBT level
CO1	Interpret foundry practices like pattern making, mold making, core making, and inspection of defects.	Apply
CO2	Differentiate various metal forming processes.	Apply
CO3	Select appropriate metal joining processes to join similar or dissimilar metals.	Understand
CO4	Classify different plastic moulding processes and applications.	Apply
CO5	Distinguish different super finishing technologies.	Analyzing (An)

Program Outcomes (POs)

PO No.	Program Outcome
PO1	Engineering Knowledge
PO2	Problem Analysis
PO3	Design/Development of Solutions
PO4	Investigation of Complex Problems
PO5	Modern Tool Usage
PO6	The Engineer and Society
PO7	Environment and Sustainability
PO8	Ethics
PO9	Individual and Team Work
PO10	Communication
PO11	Project Management and Finance
PO12	Life-long Learning

Course Outcome to Programme Outcome (CO-PO) Mapping

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



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101505

Course/Subject Name: Manufacturing Technology

Program Specific Outcomes (PSOs)

PSO No.	Program Specific Outcome
PSO1	Apply concepts of mechanical engineering in production, design, thermal, and automation fields.
PSO2	Use modern tools and manufacturing techniques for product development and system maintenance.

CO-PSO MAPPING:

	PSO1	PSO2
CO1	3	2
CO2	3	3
CO3	3	3
CO4	2	3
CO5	2	3

References/Suggested Learning Resources:

(a) Books:

1. Production technology, by R.K. Jain, Khanna publishers.
2. Production Technology by P.C. Sharma S Chand & Co Ltd.
3. Manufacturing Technology Vol-II, By P.N. Rao, Tata McGraw Hill.
4. Manufacturing Engg. And Technology By S. Kalpakajain, PHI/Pearson.
5. Welding technology, by O.P.Khanna, DhanpatRai publishers.

(b) Open-sourcewebsite:

1. NPTEL notes and videos
2. www.themanufacturinginstitute.org

Suggested Course Practical List:

Experiments based on syllabus contents including workshop job of:

1. Casting Processes
2. Welding Processes
3. Sheet metal working
4. Plastic processes

List of Laboratory/LearningResourcesRequired:

1. Mechanical Press
2. Small foundry shop
3. Welding Machine: Arc welding machine, Gas welding machine, TIG, Spot welding etc..



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101506

Course/Subject Name: Operation Research

w.e.f. Academic Year:	2024-25
Semester:	5 th SEM / 3 rd year
Category of the Course:	Humanities and Social Science

Prerequisite:	Nil
Rationale:	Operations Research now a day widely used in the area of decision making for the real life problems. Managers and decision makers get idea for optimizing and approximating industrial problems. They not only strive to devise appropriate measures for problem solving but also apply scientific techniques to monitor the organizations ongoing activities such as Production mix, Transportation, Assignment, Queuing, Game theory, Replacement and Project Management problem.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA(M)	PA(I)	ESE(V)	
3	0	0	3	60	40	00	00	100



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101506

Course/Subject Name: Operation Research

CourseContent:

Unit No.	Content	No.of Hours	% of Weightage
1	Operations Research: <ul style="list-style-type: none"> Origin of Operation Research, Historical Standpoint, Methodology, Different Phases, Characteristics, Scope and Application of Operations Research. Linear Programming Problem: Introduction, Requirement of LP, Basic Assumptions, Formulation of LP, General Statement of LP, Solution techniques of LP: Graphical Methods, Analytical Methods: Simplex, Big M and Two Phase, Special Case of LP Problem, Graphical Sensitivity Analysis. Introduction of Primal and Dual Problems, Economic Interpretation. Introduction of Goal and Integer Programing. Dynamic Programming: Steps involved in dynamic programming, characteristics and explanation of dynamic programming, formulation of Deterministic and probabilistic dynamic programming 	12	20
2	Transportation and Assignment: <ul style="list-style-type: none"> Transportation Problems definition, Linear form, Solution methods: North west corner method, least cost method, Vogel's approximation method. Degeneracy in transportation, Modified Distribution method, Unbalanced problems and profit maximization problems. Transshipment Problems. Assignment Problems and Travelling sales Problem. 	09	20
3	Queuing Theory: <ul style="list-style-type: none"> Basis of Queuing theory, elements of queuing theory, Kendall's Notation, Operating characteristics of a queuing system,]Classification of Queuing models, Preliminary examples M/M/1:∞/∞/FCFS	04	10
4	Replacement theory: <ul style="list-style-type: none"> Introduction, Replacement of capital equipment which depreciated with time, replacement by alternative equipment, Group and individual replacement policy. 	04	10



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101506

Course/Subject Name: Operation Research

5	Game Theory: <ul style="list-style-type: none"> • Introduction, Characteristics of Game Theory, Two Person, Zero sum games, • Pure strategy. Dominance theory, Mixed strategies (2x2, M x2), • Algebraic and graphical methods. 	04	10
6	Decision Theory: <ul style="list-style-type: none"> • Introduction, Decision under certainty, Decision under risk, • Decision under uncertainty: Laplace criterion, Maxi Min criterion, • Mini Max criterion, savage MiniMax regret criterion, • Hurwicz criterion, Decision tree. 	04	10
7	Project Management: <ul style="list-style-type: none"> • Introduction to PERT and CPM, Critical Path calculation, • float calculation and its importance. Cost reduction by Crashing of activity. 	08	20
	Teaching hours	45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	18	12	-	-	-

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101506

Course/Subject Name: Operation Research

Course Outcome:

After Completion of the Course , the Student will be able to:

No	Course Outcomes	RBT level
CO1	Develop models for optimizing the management and production systems from the verbal description of the real system.	Apply
CO2	Make use of LPP techniques for optimization of Production mix problem in industry.	Apply
CO3	Evaluate transportation, transshipment, assignment and travelling salesman and Queuing problem.	Understand
CO4	Apply quantitative techniques in machine replacement, game theory, business decision making under conditions of certainty, risk and uncertainty.	Apply
CO5	Demonstrate Project management Problem.	Analyzing (An)

Program Outcomes (POs)

PO No.	Program Outcome
PO1	Engineering knowledge
PO2	Problem analysis
PO3	Design/development of solutions
PO4	Conduct investigations of complex problems
PO5	Modern tool usage
PO6	The engineer and society
PO7	Environment and sustainability
PO8	Ethics
PO9	Individual and team work
PO10	Communication
PO11	Project management and finance
PO12	Life-long learning



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101506

Course/Subject Name: Operation Research

Course Outcome to Programme Outcome (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	0	0	0	1	2	2	3
CO2	3	3	2	2	3	0	0	0	1	2	2	3
CO3	3	3	2	2	2	0	0	0	1	2	2	3
CO4	2	3	2	2	2	1	1	1	1	2	2	2
CO5	2	2	3	2	3	0	0	0	2	3	3	3

Program Specific Outcomes (PSOs)

PSO No.	Program Specific Outcome
PSO1	Apply the knowledge of mathematics, science, engineering fundamentals to solve complex mechanical engineering problems.
PSO2	Use modern tools and techniques in the area of production, design, thermal and industrial engineering to solve real-life problems.

CO-PSO MAPPING:

	PSO1	PSO2
CO1	3	2
CO2	3	3
CO3	3	3
CO4	2	3
CO5	2	3

References/Suggested Learning Resources:

(a) Books:

1. Operations Research: An Introduction by HamdyTaha, Pearson Education Inc
2. Operations Research: Principles and Practice by Pradeep PrabhakarPai, Oxford Higher Education, Oxford University press
3. Operations Research: Principles and Practice by Ravindran Phillips and Solberg by Wiley India Edition,
4. Operations Research by P Mariappan, Pearson
5. Operations Research by A M Natarajan, P Balasubramani, A Tamilarasi, Pearson Education Inc
6. Operations Research by H N Wagner, Prentice hall.
7. Optimization in Operations Research by Ronald Rardin, Pearson Education Inc.



SWAMINARAYANUNIVERSITY

Program Name: Engineering

Level: UG

Course/ Subject Code: BE101506

Course/Subject Name: Operation Research

8. Operations Research by R. Paneerselvam, Prentice Hall of India Pvt. Ltd.
9. Quantitative Techniques in Management by N D Vohra, Tata McGraw-Hill

(b) Open-sourcewebsite:

1. <https://www.engineering.osu.edu>
2. www.themanufacturinginstitute.org
3. www.asme.org

Suggested Course Practical List:

List of Laboratory/LearningResourcesRequired:



SWAMINARAYANUNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE102604

Course/Subject Name: Energy Conservation and Management

w.e.f. Academic Year:	2024-25
Semester:	6 TH Semester/ 3 Year
Category of the Course:	Professional elective-3

Prerequisite:	Nil
Rationale:	

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1.	Energy Scenario: Classification of Energy, Indian energy scenario, Sectorial energy consumption (domestic, industrial and other sectors), energy needs of growing economy, energy intensity, long term energy scenario, energy pricing, energy security, energy conservation and its importance, energy strategy for the future. Energy Conservation Act 2001 and related policies: Energy conservation Act 2001 and its features, notifications under the Act, Schemes of Bureau of Energy Efficiency (BEE) including Designated consumers, State Designated Agencies, Electricity Act 2003, Integrated energy policy, National action plan on climate change, ECBC code for Building Construction.	5	10
2.	Financial Management, Energy Monitoring and Targeting: Investment-need, financial analysis techniques simple payback period, return on investment, net present value, internal rate of return, cash flows, risk and sensitivity analysis; financing options, energy performance contracts and role of Energy Service Companies (ESCOs) Energy Monitoring and Targeting: Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques – energy consumption, production, cumulative sum of differences (CUSUM). Energy Management Information Systems (EMIS)	6	20



SWAMINARAYANUNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE102604

Course/Subject Name: Energy Conservation and Management

3.	Energy Management & Audit: Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, Bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution, energy audit instruments and metering	5	20
4.	Energy Efficiency in Thermal Utilities and systems: Boilers: Types, combustion in boilers, performances evaluation, analysis of losses, feed water treatment, blow down, energy conservation opportunities. Boiler efficiency calculation, evaporation ratio and efficiency for coal, oil and gas. Soot blowing and soot deposit reduction, reasons for boiler tube failures, start up, shut down and preservation. Steam System: Properties of steam, assessment of steam distribution losses, steam leakages, steam trapping, condensate and flash steam recovery system, identifying opportunities for energy savings. Steam utilization, Performance assessment of steam system, thermo-compressor, steam pipe insulation, condensate pumping, steam dryers. Furnaces: Classification, general fuel economy measures in furnaces, excess air, heat distribution, temperature control, draft control, waste heat recovery. Forging furnace heat balance, Cupola, non-ferrous melting, Induction furnace, performance evaluation of a furnace. Insulation and Refractories: Insulation-types and application, economic thickness of insulation, heat savings and application criteria, Refractory-types, selection and application of refractories, heat loss. Cold insulation. Heat Exchangers: Types, networking, pinch analysis, multiple effect evaporators, condensers, distillation column, etc. Waste Heat Recovery: Classification, advantages and applications, commercially viable waste heat recovery devices, saving potential. Cogeneration: Definition, need, application, advantages, classification, saving potentials. Heat balance, steam turbine efficiency, tri-generation, micro turbine. Heating, ventilation, air conditioning (HVAC) and Refrigeration System: Factors affecting Refrigeration and Air conditioning system performance and savings Opportunities. Vapor absorption refrigeration system: Working principle, types and comparison with vapor compression system and saving potential, heat pumps and their applications, section on ventilation system, and performance assessment of window and split room air conditioners and star labels	22	30
5.	Energy and environment, air pollution, climate change: United Nations Framework Convention on Climate Change (UNFCCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), CDM Procedures case of CDM – Bachat Lamp Yojna and industry; Prototype Carbon Fund (PCF).	4	20
		42	100



SWAMINARAYANUNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE102604

Course/Subject Name: Energy Conservation and Management

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10%	20%	25%	20%	15%	10%

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	To summarize the energy conservation scenario, energy and environment, air pollution, climate change, and various acts and policy for the energy conservation	Remembering (R) / Understanding (U)
2	To infer the concept of financial management, energy monitoring and targeting.	Understanding (U)
3	To apply the knowledge of energy audit for the energy management and operation of energy audit instruments.	Applying (A)
4	To analyze the energy saving area and improvement in efficiency of various thermal utilities and systems.	Analyzing (AN)
5	To evaluate the net present worth in financial management and performance assessment of various thermal utilities and systems.	Evaluating (E)



SWAMINARAYANUNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE102604

Course/Subject Name: Energy Conservation and Management

Course Outcome to Program Outcome (CO-PO) Mapping

CO-PO Mapping					
PO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1 Basic Engg Knowledge	2	2	2	2	2
PO-2 Problem Analysis	2	3	2	3	3
PO-3 Design/Development	1	2	3	3	2
PO-4 Investigations	1	2	2	3	3
PO-5 Modern Tool Usage	1	2	2	2	2
PO-6 Engineer & Society	2	1	1	1	2
PO-7 Environment & Sustainability	3	2	1	1	2
PO-8 Ethics	2	1	0	0	1
PO-9 Individual & Team Work	1	1	1	1	1
PO-10 Communication	1	1	2	2	2
CO-PSO Mapping					
PSO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5
PSO1 (Automobile Manufacturing Skills)	2	3	3	3	3
PSO2 (Design and Analysis)	2	2	2	3	3

References/Suggested Learning Resources:

(a) Books:

- 1 Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, 2nd Edition, CRC Press
- 2 Handbook of Energy Audits, Albert Thumann, 6th Edition, The Fairmont Press.
- 3 Bureau of Energy Efficiency Reference book: No.1, 2, 3, 4.
- 4 Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Interscience publication.
- 5 Carbon Capture and Sequestration: Integrating Technology, Monitoring, and Regulation edited by E J Wilson and D Gerard, Blackwell Publishing.
- 6 Heating and Cooling of Buildings - Design for Efficiency, J. Krieder and A. Rabl, McGraw Hill Publication, 1994.



SWAMINARAYANUNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE102604

Course/Subject Name: Energy Conservation and Management

(b) Open source software and website:

- <http://nptel.ac.in/>
- www.learnerstv.com
- <http://auto.howstuffworks.com/>

(C) Suggested Course Practical List:

- 1 To study the various Acts and policy for the energy conservation.
- 2 To study the financial analysis techniques, energy performance contracts, role of energy service companies and evaluate net present worth for the finance.
- 3 To study the elements of energy monitoring and targeting, techniques, CUSUM and Energy Management Information Systems (EMIS).
- 4 To study and perform the use of energy audit instruments and prepare the energy audit report.
- 5 To study and performance evaluation, analysis of losses and energy saving opportunities for the boiler.
- 6 To study and performance evaluation, analysis of losses and energy saving opportunities for the steam system.
- 7 To study the types of insulation and refractories, economic thickness of insulation and selection criteria for the insulation and refractories.
- 8 To study and performance evaluation, analysis of losses and energy saving opportunities for the furnace.
- 9 To study and performance evaluation and energy saving opportunities for the window and split air-conditioner.
- 10 To study the framework for climate change, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), CDM Procedures and case of CDM

(D) List of Laboratory/Learning Resources Required:

1. Pyranometer
2. Sunshine Recorder
3. Solar Power Meter
4. Solar Liquid Flat Plate Collector
5. Solar Air Heater
6. Cylindrical Parabolic Collector



SWAMINARAYANUNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE102604

Course/Subject Name: Energy Conservation and Management

7. Compound Parabolic Collector
8. Box-type Solar Cooker
9. Solar Drier
10. Solar Still

Suggested Project List:

- 1 Impact Assessment of Energy Conservation Acts and Policies
- 2 Financial Evaluation of Energy Performance Contracts
- 3 Design of Energy Monitoring and Targeting System Using EMIS and CUSUM
- 4 Energy Audit and Reporting of an Educational or Industrial Facility
- 5 Performance Evaluation and Loss Analysis of an Industrial Boiler
- 6 Energy Efficiency Assessment of Steam Distribution Systems



SWAMINARAYANUNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE102602

Course/Subject Name: Design of Heat exchangers

w.e.f. Academic Year:	2024-25
Semester:	6 TH Semester/ 3 Year
Category of the Course:	Professional Elective -I

Prerequisite:	Nil
Rationale:	The course is design to provide fundamental knowledge of different type of heat exchangers used for various thermal applications and to learn the sizing of heat exchangers, thermal analysis for various heat exchange applications.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1.	Different classification and basic design methodologies for heat exchanger: Classification of heat exchanger, selection of heat exchanger, overall heat transfer coefficient, LMTD method for heat exchanger analysis for parallel, counter, multi-pass and cross flow heat exchanger, e-NTU method for heat exchanger analysis, fouling, cleanliness factor, percent over surface, techniques to control fouling, additives, rating and sizing problems, heat exchanger design methodology	11	25
2.	Design of double pipe heat exchangers: Thermal and hydraulic design of inner tube and annulus, hairpin heat exchanger with bare and finned inner tube, total pressure drop	8	20
3.	Design of Shell & tube heat exchangers: Basic components, basic design procedure of heat exchanger, TEMA code, J-factors, conventional design methods, Bell-Delaware method	10	25



SWAMINARAYANUNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE102602

Course/Subject Name: Design of Heat exchangers

4.	Design of compact heat exchangers: Heat transfer enhancement, plate fin heat exchanger, tube fin heat exchanger, plate heat exchanger, heat transfer and pressure drop	10	20
5.	Heat Transfer Enhancement and Performance Evaluation: Enhancement of heat transfer, Performance evaluation of Heat Transfer Enhancement technique. Introduction to pinch analysis.	6	10
Teaching hours		45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
8%	23%	27%	17%	15%	10%

Where R: Remember; U: Understanding; A: Application; N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	To select appropriate heat exchanger for the given application and to measure the performance degradation of heat exchangers subject to fouling	Evaluating (E)
2	To analyse thermal and hydraulic performance of different types of compact heat exchangers.	Applying (A)
3	To compare various heat transfer enhancement techniques and to apply process optimization techniques for heat exchanger design	Applying (A)

Course Outcome to Program Outcome (CO-PO) Mapping

CO-PO Mapping			
PO \ CO	CO-1	CO-2	CO-3
PO-1 Basic Engg Knowledge	3	3	3
PO-2 Problem Analysis	2	3	2
PO-3 Design/Development	2	3	3
PO-4 Investigations	2	2	2
PO-5 Modern Tool Usage	2	1	2
PO-6 Engineer & Society	1	1	1



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Program Name: Engineering Level: Degree

Course/ Subject Code: BE102602

Course/Subject Name: Design of Heat exchangers

PO-7 Environment & Sustainability	1	1	1
PO-8 Ethics	1	1	1
PO-9 Individual & Team Work	1	2	2
PO-10 Communication	2	2	3
CO-PSO Mapping			
PSO \ CO	CO-1	CO-2	CO-3
PSO1 (Automobile Manufacturing Skills)	3	2	3
PSO2 (Design and Analysis)	2	3	3
PSO3	2	2	3

References/Suggested Learning Resources:

(a) Books:

1. Heat Exchanger Selection, Rating and Thermal Design by Sadik, Kakac, CRC Press
2. Fundamentals of Heat Exchanger Design by Ramesh K Shah, Wiley Publication
3. Compact Heat Exchangers by Kays, V.A. and London, A.L., McGraw Hill
4. Heat Exchanger Design Handbook by Kuppan, T, Macel Dekker, CRC Press
5. Heat Exchanger Design Hand Book by Schunder E.U., Hemisphere Pub.
6. Process Heat transfer by Donald Q Kern, McGraw Hill

(b) Open source software and website:

- <http://nptel.ac.in/>
- www.learnerstv.com
- <http://auto.howstuffworks.com/>

(C) Suggested Course Practical List:

1. Design of heat exchange equipment by using LMTD method.
2. Design of heat exchange equipment by using effectiveness– NTU method.
3. Measure the effectiveness of shell and tube heat exchanger.
4. Design and analysis of Parallel flow and Counter flow heat exchanger.



SWAMINARAYANUNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE102602

Course/Subject Name: Design of Heat exchangers

5. Design and analysis of Shell and tube type heat exchanger.
6. Design and analysis of Plate type heat exchanger.

(D) List of Laboratory/Learning Resources Required:

1. Shell and tube heat exchanger,
2. Plate type heat exchanger,
3. Tube and tube heat exchanger,
- 4 Compact heat exchanger.

Suggested Project List:

1. Design and Fabrication of a Shell and Tube Heat Exchanger
2. Thermal Performance Analysis of Plate Type Heat Exchangers
3. Comparison of LMTD and NTU Methods in Heat Exchanger Design
4. Design Optimization of Compact Heat Exchanger for Automotive Applications
5. Effect of Fouling on Heat Exchanger Efficiency and Its Control Techniques
6. Design of Double Pipe Heat Exchanger for Industrial Cooling Systems
7. Simulation of Heat Exchanger Performance Using ANSYS/CFD Tools
8. Performance Evaluation of Heat Transfer Enhancement Techniques
9. Economic and Thermal Comparison of Different Heat Exchanger Types
10. Pinch Analysis-Based Optimization of Heat Exchanger Networks



SWAMINARAYANUNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE102603

Course/Subject Name: Renewable Energy Engineering

w.e.f. Academic Year:	2024-25
Semester:	6 TH Semester/ 3 Year
Category of the Course:	Professional elective-2

Prerequisite:	Nil
Rationale:	This course introduces students to renewable energy sources and their applications. It helps them understand solar, wind, bio, and other energy systems, along with their design, performance, and economic analysis. The course supports the shift towards sustainable and clean energy solutions.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1.	Scenario of Renewable Energy (RE) Sources: Need of RE, advantages and limitations of RE, present energy scenario of conventional and RE sources.	1	10
2.	Solar Energy: Energy available from the sun, spectral distribution, solar radiation outside the earth's atmosphere and at the earth's surface, solar radiation geometry, Instruments for solar radiation measurements, empirical equations for prediction of availability of solar radiation on horizontal, radiation on and tilted surface. Solar energy conversion into heat, types and working of solar collectors, evacuated and non-evacuated solar air heater, concentrated collectors, losses in liquid flat plate collector, thermal analysis of liquid flat plate collector, air heater and cylindrical parabolic concentrating collector, solar energy thermal storage, Solar space heating and cooling of buildings, solar pumping, solar cooker, solar still, solar drier, solar refrigeration and air-conditioning, solar pond, heliostat, solar furnace, photovoltaic system for power generation, solar cell modules and arrays, solar cell types, material, applications, advantages and disadvantages.	19	30



SWAMINARAYANUNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE102603

Course/Subject Name: Renewable Energy Engineering

3.	Wind Energy: Energy available from wind, basics of lift and drag, basics of wind energy conversion system, Betz limit theory, effect of density, angle of attack and wind speed, wind mill rotors, horizontal and vertical axes rotors, drag, lift, torque and power coefficients, tip speed ratio, solidity of turbine, wind turbine performance curves, wind energy potential and site selection, basics of wind farm, Safety and environmental aspects, wind energy potential and installation in India	8	20
4.	Bio Energy: Biomass energy – modern energy carrier, energy plantation, gasification, types and applications of gasifiers, types of biogas plants, design of biogas plant, factors affecting biogas generation. advantages and disadvantages.	4	10
5.	Ocean Energy: OTEC principle, open, closed and hybrid cycle OTEC system, Energy from tides, estimation of tidal power, tidal power plants, single and double basin plants, site requirements, advantages and limitations Wave energy: Wave energy conversion devices, advantages and disadvantages, Present scenario. Geothermal energy: Introduction, vapor and liquid dominated systems, binary cycle, hot dry rock resources, magma resources, advantages and disadvantages, applications. MHD Power generation: concept and working principle.	7	10
6.	Economic Analysis: Initial and annual cost, Basic definitions Fundamentals of economic analysis, time value of money, payback period, present worth calculations, repayment of loan in equal annual installments, annual solar savings, cumulative saving and life cycle cost analysis, economic analysis of solar system, clean development mechanism	6	20
		45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10%	25%	30%	15%	10%	10%

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



SWAMINARAYANUNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE102603

Course/Subject Name: Renewable Energy Engineering

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	To design and develop solar systems for various applications .	Create (C)
2	To estimate solar radiation on the various surfaces and its applications for thermal and photovoltaic system.	Apply (A)
3	To analyze the performance of various solar collectors	Analyze (N)
4	To evaluate the potential of wind energy conversion systems	Evaluate (E)
5	To illustrate Bio energy, Wave energy, Ocean energy and Geothermal Energy.	Understand (U)
6	To evaluate the life cycle cost and carry out economic analysis of renewable energy sources.	Create (C)

Course Outcome to Program Outcome (CO-PO) Mapping

CO-PO Mapping						
PO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO-1 Basic Engg Knowledge	2	2	2	2	2	2
PO-2 Problem Analysis	2	3	2	2	2	3
PO-3 Design/Development	3	3	3	3	2	2
PO-4 Investigations	2	2	3	2	1	3
PO-5 Modern Tool Usage	2	2	1	2	1	1
PO-6 Engineer & Society	1	1	1	1	1	2
PO-7 Environment & Sustainability	2	2	1	2	2	2
PO-8 Ethics	0	0	0	0	1	0
PO-9 Individual & Team Work	1	1	1	1	1	1
PO-10 Communication	2	1	1	1	1	2
CO-PSO Mapping						
PSO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PSO1 (Automobile Manufacturing Skills)	3	3	2	2	2	3
PSO2 (Design and Analysis)	2	3	3	2	2	2



SWAMINARAYANUNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE102603

Course/Subject Name: Renewable Energy Engineering

References/Suggested Learning Resources:

(a) Books:

1. Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak, McGrawHill Education
2. Solar Engineering of Thermal Processes, John A. Duffie, William A. Beckman, John Wiley, New York
3. Non-conventional Energy Resources, B. H. Khan, Tata McGraw Hill
4. Non-Conventional Resources of Energy, G. S. Sawhney, PHI
5. Non-conventional energy resources, Shobh Nath Singh, Pearson India
6. Solar Energy Engineering, Soteris Kalogirou, Elsevier/Academic Press.
7. Principles of Solar Energy, Frank Krieth & John F Kreider, John Wiley, New York

(b) Open source software and website:

- <http://nptel.ac.in/>
- www.learnerstv.com
- <http://auto.howstuffworks.com/>

(C) Suggested Course Practical List:

1. To study and measure the solar radiation on horizontal and tilted surface using solar radiation measuring instruments.
2. To evaluate the performance of solar liquid flat plate collector.
3. To evaluate the performance of solar air heater.
4. To evaluate the performance of concentrating collectors.
5. To evaluate the performance of solar still.
6. To evaluate the performance of box type solar cooker.
7. To study the various types of wind mill and evaluate the performance parameter of wind. mill.
8. To study the various types of gasifier and biogas plant.
9. To study the ocean energy, wave energy, geothermal energy conversion systems.
10. To estimate the economics of the solar energy conversion equipment.
- 11.

(D) List of Laboratory/Learning Resources Required:

1. Pyranometer
2. Sunshine Recorder
3. Solar Power Meter



SWAMINARAYANUNIVERSITY

Program Name: Engineering Level: Degree

Course/ Subject Code: BE102603

Course/Subject Name: Renewable Energy Engineering

4. Solar Liquid Flat Plate Collector
5. Solar Air Heater
6. Cylindrical Parabolic Collector
7. Compound Parabolic Collector
8. Box-type Solar Cooker
9. Solar Drier
10. Solar Still

Suggested Project List:

1. Design and Fabrication of a Portable Solar Water Heater
2. Performance Analysis of a Box-type Solar Cooker
3. Development of a Low-cost Solar Dryer for Agricultural Use
4. Design and Testing of a Solar-Powered Mobile Charging Station



Swaminarayan University

Teaching & Examination Scheme
Course – Faculty of Engineering (Degree)
Branch – Mechanical Engineering
Semester – 5th

Subject Code	Subject Name	Category	L	T	P	Total Credit	E	M	I	V	Total Marks
BE100501	Contributor Personality Development Program	Personality Development (Elective)	2	0	0	2	60	40	20	30	150
BE100502	Integrated Personality Development Course		2	0	0	2	60	40	20	30	150
BE101506	Operation Research	Humanities and Social Science	3	0	0	3	60	40	0	0	100
BE101505	Manufacturing Technology	Professional Core	3	0	2	4	60	40	20	30	150
BE101501	Heat Transfer	Professional Core	4	0	2	5	60	40	20	30	150
BE101502	Dynamics of Machinery	Professional Core	4	0	2	5	60	40	20	30	150
BE101503	Control Engineering	Open Elective - 1	3	0	0	3	60	40	0	0	100
BE101504	Oil Hydraulics and Pneumatics		3	0	0	3	60	40	0	0	100
	Total		19	0	6	22					

L=Lecture, T=tutorial, P=Practical, E=Theory External, M=Theory Internal, I=Practical Internal, V=Practical External