DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY UTTAR PRADESH, LUCKNOW

EVALUATION SCHEME & SYLLABUS

FOR

B. TECH. 3rd YEAR (EN)

ELECTRICAL & ELECTRONICS ENGINEERING

BASED ON

AICTE MODEL CURRICULUM

[Effective from the Session: 2020-21]

EVALUATION SCHEME - B.TECH 3rd YEAR (ELECTRICAL & ELECTRONICS ENGINEERING)

SEMESTER V

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KEE501	Power System - I	3	1	0	30	20	50		100		150	4
2	KEE502	Control System	3	1	0	30	20	50		100		150	4
3	KEE503	Electrical Machines-II	3	1	0	30	20	50		100		150	4
4	KE*051-KE*054	Departmental Elective-I	3	0	0	30	20	50		100		150	3
5	KEE055-KEE058	Departmental Elective-II	3	0	0	30	20	50		100		150	3
6	KEE551	Power System-I Lab	0	0	2				25		25	50	1
7	KEE552	Control System Lab	0	0	2				25		25	50	1
8	KEE553	Electrical Machines - II Lab	0	0	2				25		25	50	1
9	KEN554	Mini Project or Internship Assessment*	0	0	2				50			50	1
10	KNC501/ KNC502	Constitution of India, Law and Engineering / Indian Tradition, Culture and Society	2	0	0	15	10	25		50			
11		MOOCs (Essential for Hons. Degree)											
		Total	**17**	**3**	**8**							**950**	**22**

**The Mini Project or internship (4 weeks) conducted during summer break after IV semester and will be assessed during V semester.*

DEPARTMENT ELECTIVE - I

KEE051 Robotics
KEE052 Sensors and Transducers
KEE053 Industrial Automation and Control
KEN051 Bio-Medical Instrumentation

DEPARTMENT ELECTIVE - II

KEE055 Optimization Techniques
KEE056 Neural Networks & Fuzzy System
KEE057 Digital Signal Processing
KEE058 Analog & Digital Communication

SEMESTER VI

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KEE601	Power System-II	3	1	0	30	20	50		100		150	4
2	KEE602	Microprocessor and Microcontroller	3	1	0	30	20	50		100		150	4
3	KEE603	Power Electronics	3	1	0	30	20	50		100		150	4
4	KE*06*	Departmental Elective-III	3	0	0	30	20	50		100		150	3
5	KOE06*	Open Elective-I	3	0	0	30	20	50		100		150	3
6	KEE651	Power System-II Lab	0	0	2				25		25	50	1
7	KEE652	Microprocessor and Microcontroller Lab	0	0	2				25		25	50	1
8	KEE653	Power Electronics Lab	0	0	2				25		25	50	1
10	KNC601/ KNC602	Constitution of India, Law and Engineering / Indian Tradition, Culture and Society	2	0	0	15	10	25		50			
11		MOOCs (Essential for Hons. Degree)											
		Total	**17**	**3**	**6**							**900**	**21**

DEPARTMENT ELECTIVE - III

KEE 061 Special Electrical Machines
KEN 061 Linear Integrated Circuits
KEE 063 Digital Control System
KEN 062 Embedded Systems

B.Tech 3rd Year

VI Semester

Syllabus

POWER SYSTEMS-II

Pre-requisites of course: Basic Electrical Engineering, Networks Analysis and Synthesis, Electromagnetic Field Theory, Power System-I, Electrical Machines-II

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO1	Identify power system components on one line diagram of power system and its representation including the behaviour of the constituent components and sub systems and Analyse a network under both balanced and unbalanced fault conditions and design the rating of circuit breakers.	**K4**
CO2	Perform load flow analysis of an electrical power network and interpret the results of the analysis.	**K4**
CO3	Describe the concept of travelling waves in transmission lines and use the travelling wave theory to determine the over voltage caused by surge propagation in transmission networks.	**K4**
CO4	Assess the steady state and transient stability of the power system under various conditions.	**K4**
CO5	Describe Operating Principle of a relay and classify them according to applications. Explain working principle of Circuit breaker and phenomenon of arc production and quenching.	**K3**

KL- Bloom's Knowledge Level (K1, K2, K3, K4, K5, K6)
K1 – Remember K2 – Understand K3 – Apply K4 – Analyze K5 – Evaluate K6 – Create

Detailed Syllabus:

UNIT-I (Fault Analysis in Power System):
One-line diagram, Impedance and reactance diagram, per unit system changing the base of per unit quantities, advantages of per unit system.

Symmetrical Components: Significance of positive, negative and zero sequence components, Average 3-phase power in terms of symmetrical components, sequence impedances and sequence networks.

Fault Calculations: Fault calculations, sequence network equations, single line to ground fault, line to line fault, double line to ground fault, three phase faults, faults on power systems, and faults with fault impedance, reactors and their location, short circuit capacity of a bus

UNIT-II (Load Flow Analysis):
Introduction, Formation of Z_{BUS} and Y_{BUS}, development of load flow equations, load flow solution using Gauss Siedel and Newton-Raphson method, Comparison of Gauss Siedel and Newton Raphson Method, approximation to N-R method, fast decoupled method.

UNIT-III (Travelling Waves in Power System):

Travelling Waves on Transmission Lines: Production of traveling waves, open circuited line, short circuited line, line terminated through a resistance, line connected to a cable, reflection and refraction at T-junction line terminated through a capacitance, capacitor connection at a T-junction, Attenuation of travelling waves, Bewley's Lattice diagram.

UNIT-IV (Stability in Power System):
Power flow through a transmission line, Stability and Stability limit, Steady state stability study, derivation of Swing equation, transient stability studies by equal area criterion. Factors affecting steady state and transient stability and methods of improvement.

UNIT-V (Introduction to Power System Protection):
Relays: Operating Principle of a general relay,
Basic Terminology: Relay, Energizing Quantity, setting, Pickup, drop out, Flag, fault clearing time, Relay time, Breaker time, Overreach, Underreach; Classification of Relays according to applications, according to time. Overcurrent Relay, Distance Protection, Differential Protection.
Circuit Breakers: Arc Phenomenon, Arc Extinction and its Methods, Restriking Voltage & Recovery Voltage, Circuit Breaker Rating.

Text Books:

1. D.P. Kothari & I.J. Nagrath, "Modern Power System Analysis" Tata Mc Graw Hill, 3rd Edition.
2. P.S.R. Murthy, "Operation and control in Power Systems" B.S. Publications.
3. W. D. Stevenson, "Elements of Power System Analysis", McGraw Hill
4. J. Wood & B.F. Wollenburg, "Power Generation, Operation and Control " John Wiley & Sons.
5. S. S. Rao, "Switchgear and Protection", Khanna Publishers.
6. B. Ravindranath and M. Chander, Power system Protection and Switchgear, Wiley Eastern Ltd.

Reference Books:

1. O.I. Elgerd, "Electric Energy System Theory" Tata McGraw Hill.
2. P. Kundur, "Power System Stability and Control Mc Graw Hill.
3. T. K. Nagsarkar & M.S. Sukhija,' Power System Analysis' Oxford University Press.
4. Hadi Sadat, "Power System Analysis", Tata McGraw Hill.
5. B. Ram and D. N. Vishwakarma, "Power System Protection and Switchgear", Tata Mc. Graw Hill

MICROPROCESSOR AND MICROCONTROLLER

Pre-requisites of course: Digital Electronics, Computer Basics

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Demonstrate the basic architecture of 8085 & 8086 microprocessors	K2
CO2	Illustrate the programming model of microprocessors & write program using 8085 microprocessor	K3
CO3	Interface different external peripheral devices with 8085 microprocessor	K3
CO4	Comprehend the architecture of 8051 microcontroller	K2
CO5	Compare advance level microprocessor & microcontroller for different applications	K4

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed Syllabus:

Unit- I:
Introduction to Microprocessor: Microprocessor architecture and its operations, Memory, Input & output devices, The 8085 MPU- architecture, Pins and signals, Timing Diagrams, Logic devices for interfacing, Memory interfacing, Interfacing output displays, Interfacing input devices, Memory mapped I/O.
Basic Programming concepts:, Flow chart symbols, Data Transfer operations, Arithmetic operations, Logic Operations, Branch operation, Writing assembly language programs, Programming techniques: looping, counting and indexing. Additional data transfer and 16 bit arithmetic instruction, Logic operation: rotate, compare, counter and time delays, 8085 Interrupts.

Unit-II:
Intel 8086 microprocessor: Internal architecture (Bus Interface Unit, Execution unit, Pipelining, Register organization), Pin Diagram, Memory addressing, Physical memory organization, Interrupts (hardware & software interrupts)

Unit-III:
Peripheral Devices: 8237 DMA Controller, 8255 programmable peripheral interface, 8253/8254programmable timer/counter, 8259 programmable interrupt controller, 8251 USART and RS232C.
Fundamental of Programming: Program structure & programming techniques for microprocessors, 8085 Addressing modes, 8085 Instruction set, Assembly language programming of 8085 microprocessor with examples (arithmetic operations on 8-bit numbers – add, subtract, multiply, divide, square & square root etc, largest/ smallest number; ascending/ descending order).

Unit-IV:
8051 Microcontroller Basics: Inside the Computer, Microcontrollers and Embedded Processors, Block Diagram of 8051, PSW and Flag Bits, 8051 Register Banks and Stack, Internal Memory Organization of 8051, IO Port Usage in 8051, Types of Special Function Registers and their uses in 8051, Pins Of 8051. Memory Address Decoding, 8031/51 Interfacing With External ROM And RAM. 8051 Addressing Modes.

Unit-V:

Assembly programming and instruction of 8051: Introduction to 8051 assembly programming, Assembling and running an 8051 program, Data types and Assembler directives, Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming. Programming 8051 Timers. Serial Port Programming, Interrupts Programming, Comparison of Microprocessor, Microcontroller, PIC and ARM processors and their application areas.

Text Books:

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 6th Edition, Penram International Publication (India) Pvt. Ltd.,2013
2. Mazidi Ali Muhammad, Mazidi Gillispie Janice, and McKinlay Rolin D., "The 8051 Microcontroller and Embedded Systems using Assembly and C", Pearson, 2nd Edition,2006
3. Senthil Kumar Saravanan, Jeevanathan, Microprocessor and Microcontrollers, Oxford,2010
4. D. V. Hall : Microprocessors Interfacing, , McGraw 3rd Edition
5. Fundamental of Microprocessor and Microcontrollers, B. RAM, Dhanpat Rai Publication
6. Soumitta Kumar Mandal, Microprocessor and Microcontrollers Architecture Programming and Interfacing using 8085,8086 and 8051, McGraw Hill
7. K. Ayala , 8051 Microcontroller, Cengage learning

Reference Books:

1. Kenneth L. Short, "Microprocessors and programmed Logic", 2nd Ed, Pearson Education Inc.,2003
2. Barry B. Brey, "The Intel Microprocessors, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro Processor, PentiumII, PentiumIII, Pentium IV, Architecture, Programming & Interfacing", Eighth Edition, Pearson Prentice Hall, 2009.
3. Senthil Kumar Saravanan, Jeevanathan, Microprocessor and Microcontrollers, Oxford,2010
4. Shah Satish, "8051 Microcontrollers MCS 51 Family and its variants", Oxford,2010

POWER ELECTRONICS

Pre-requisites of course: Basic Electrical Engineering, Network Analysis & Synthesis

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Demonstrate the characteristics as well as the operation of BJT, MOSFET, IGBT, SCR, TRIAC and GTO and identify their use in the power switching applications.	**K4**
CO2	Comprehend the non-isolated DC-DC converters and apply their use in different Power electronics applications.	**K3**
CO3	Analyze the phase controlled rectifiers and evaluate their performance parameters.	**K5**
CO4	Apprehend the working of single-phase ac voltage controllers, cyclo-converters and their various applications.	**K3**
CO5	Explain the single-phase and three phase bridge inverters differentiate between CSI and VSI and apply PWM for harmonic reduction.	**K4**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed Syllabus:

Unit-I: Power semiconductor devices:
Introduction: Concept of Power Electronics, scope and applications, desired Characteristics of controllable switches
Power semiconductor switches and their characteristics: Power Diode, Power BJT, Power MOSFET, IGBT, SCR, TRIAC, GTO.

Unit-II:
Thyristor: Rating & protection, Methods of SCR commutation, Gate Drive Circuit, Series and Parallel operation.
DC-DC Converters: Introduction, Control Strategies, Buck converter, Boost Converter, Buck-Boost converter, Analysis of buck converter, Switched Mode power Supply (SMPS).

Unit-III: Phase Controlled Converters:
Single phase half wave controlled rectifier with various loads, Effect of freewheelingdiode, Single phase fully controlled and half controlled bridge converters with various loads. Performance Parameters of single phase uncontrolled and controlled converters, three phase half wave converters, Three phase fully controlled and half controlled bridge converters, Effect of source impedance, Single phase and three phase dual converters

Unit-IV: AC Voltage Controllers:
Principle of On-Off and phase controls, Single phase ac voltage controller with resistive and inductive loads, sequence control, Introduction to Matrix converter.

Cyclo Converters: Basic principle of operation, single phase to single phase, three phase to single phase output voltage equation.

Unit-V: Inverters:
Single phase and Three phase bridge inverters, voltage source inverters, current source inverters, Voltage control of single phase inverters, Pulse width modulation, Introduction to Multi level inverter.

Text Books:

1. M.H. Rashid,"Power Electronics: Circuits, Devices & Applications", Pearson Education.
2. Ned Mohan, T.M.Undeland and W.P.Robbins, "Power Electronics: Converters, Applications and Design", Wiley India Ltd,2008
3. P.C. Sen, "Power Electronics", McGraw Hill Education (India) Pvt. Ltd.
4. P.S. Bhimbra, "Power Electronics", Khanna Publishers.

Reference Books:

1. M.S. Jamil Asghar, "Power Electronics" Prentice Hall of India Ltd., 2004
2. Chakrabarti & Rai, "Fundamentals of Power Electronics & Drives"Dhanpat Rai & Sons.
3. V.R. Moorthy, "Power Electronics: Devices, Circuits and Industrial Applications" Oxford University Press,2007
4. S.N.Singh, "A Text Book of Power Electronics" Dhanpat Rai & Sons

POWER SYSTEM LAB-II

Pre-requisites of course: Power System-I Lab

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO1	Test various relays for different characteristics and compare with the performance characteristics provided by manufacturers.	**K4**
CO2	Select the power system data for load-flow and fault studies and to develop a program to solve power flow problem using NR and GS methods	**K6**
CO3	Analyze various types of short circuit faults	**K4**
CO4	Demonstrate different numerical integration methods and factors influencing transient stability	**K3**
CO5	Determine the effect of load in long transmission line	**K3**

Note: - Minimum 10 experiments are to be performed from the following list:

(A) Hardware Based Experiments:

1. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation.
2. To Study the over-current relay and the effect of PSM and TSM.
3. To study percentage differential relay.
4. To study Impedance, MHO and Reactance type distance relays and zones of protection.
5. To study Ferranti effect of a transmission line/cable.
6. To measure the dielectric Strength of transformer oil.
7. To study the Synchronization of alternator with infinite bus bar.
8. To determine positive sequence, negative sequence and zero sequence reactance of an alternator.
9. To Study the effect of different shape of electrodes on dielectric (air) breakdown.
10. To Study the gas actuated Buchholz relay for oil filled transformer.
11. To determine the sub-transient (xd″), transient (xd′) and steady state reactance (xd) of a synchronous machine.

***The available Experiments from above list may be performed on virtual lab on following virtual lab link:** http://vlab.co.in/

(B) Simulation Based Experiments (using Scilab/MATLAB or any other equivalent open source software platform)

1. To obtain formation of Y-bus.
2. Perform load flow analysis on a 3- Bus System using G-S Method.
3. Perform load flow analysis on a 3- Bus System using N-R Method.
4. To perform symmetrical fault analysis in a power system.

5. To perform unsymmetrical fault analysis in a power system.
6. Swing Curve by Step-by-Step Method.
7. Determination of the stability of a SMIB system in occurrence of a fault by solving the Swing equation by Euler's Method.

Text Books: -

1. Haadi Sadat, "Power System Analysis" Tata McGraw Hill.
2. T.K. Nagsarskar & M.S. Sukhija, Power System Analysis' Oxford University Press.
3. K. Umarao, "Computer Techniques and Models in Power System", Wiley

MICROPROCESSOR AND MICROCONTROLLER LAB

Pre-requisites of course: Digital Electronics, Computer Basics

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Study of microprocessor system	K2
CO2	Development of flow chart for understanding the data flow	K3
CO3	Learning assembly language to program microprocessor based system	K3
CO4	Interfacing different peripheral devices with the microprocessor	K4
CO5	Building logic for microprocessor based system	K4

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Note: Minimum ten experiments are to be performed from the following list (on 8085 / 8086 microprocessor)

1. To study 8085 / 8086 based microprocessor system
2. To perform mathematical operations (addition & subtraction) on two 8-bit numbers
3. To perform multiplication on two 8-bit numbers
4. To perform division on two 8-bit numbers
5. To develop and run a program for finding out the largest number from given two 8-bit numbers
6. To develop and run a program for finding out the smallest number from given two 8-bit numbers
7. To develop and run a program for arranging in ascending order of a given set of 8-bit numbers
8. To develop and run a program for arranging in descending order of a given set of 8-bit numbers
9. To perform conversion of temperature from degree F to degree C
10. To perform computation of square root of a given number
11. To obtain interfacing of 8255 – PPI with 8085 microprocessor
12. To perform microprocessor based traffic light control
13. To perform microprocessor based stepper motor operation through 8085 / 8086 kit
14. To obtain interfacing of DMA controller with 8085 / 8086 microprocessor

PART B SUGGESTIVE LIST OF EXPERIMENTS (Through Virtual Lab Link):

1. Write a program using 8085 Microprocessor for Decimal, Hexadecimal addition and subtraction of two Numbers. ***(Through Virtual Lab Link)***
2. Write a program using 8085 Microprocessor for addition and subtraction of two BCD numbers. ***(Through Virtual Lab Link)***
3. To perform multiplication and division of two 8 bit numbers using 8085. ***(Through Virtual Lab Link)***
4. To find the largest and smallest number in an array of data using 8085 instruction set.
5. To write a program using 8086 to arrange an array of data in ascending and descending order. ***(Through Virtual Lab Link)***
6. To convert given Hexadecimal number into its equivalent ASCII number and vice versa using 8086 instruction set.
7. To convert given Hexadecimal number into its equivalent BCD number and vice versa using 8086 instruction set.
8. To interface 8253 programmable interval timer and verify the operation of 8253 in six different modes.
9. To write a program to initiate 8251 and to check the transmission and reception of character.
10. Serial communication between two 8085 through RS-232 C port.
11. Write a program of Flashing LED connected to port 1 of the 8051 Micro Controller
12. Write a program to generate 10 kHz square wave using 8051.
13. Write a program to show the use of INT0 and INT1 of 8051.
14. Write a program for temperature & to display on intelligent LCD display.
15. Interfacing of Stepper motor to 8051.
16. Interfacing of ADC to 8051.

Virtual Lab Link: http://vlabs.iitb.ac.in/vlabs-dev/labs_local/microprocessor/labs/explist.php

Available on: http://www.vlab.co.in/broad-area-electronics-and-communications

POWER ELECTRONICS LABORATORY

Pre-requisites of course: Basic Electrical Engineering, Network Analysis & Synthesis

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Demonstrate the characteristics and triggering of IGBT, MOSFET, Power transistor and SCR.	**K3**
CO2	Analyze the performance of single phase fully controlled bridge rectifiers under different loading conditions.	**K4**
CO3	Develop simulation models of power electronic circuits.	**K5**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Note: Minimum 10 experiments are to be performed from the following list:.

1. To study triggering of (i) IGBT (ii) MOSFET (iii) power transistor
2. To study V-I characteristics of SCR and measure latching and holding currents.
3. To compare the R, RC & UJT trigger circuit for SCR.
4. To study the commutation circuit for SCR.
5. To study single phase fully controlled bridge rectifiers with resistiv e and inductive loads.
6. To study single phase fully controlled bridge rectifiers with DC motor load.
7. To study three-phase fully controlled bridge rectifier with resistive and inductive loads.
8. To study single-phase ac voltage regulator with resistive and inductive loads.
9. To study single phase cyclo-converter
10. To study the four quadrant operation of chopper circuit
11. To study MOSFET/IGBT based single-phase bridge inverter.

Software based experiments (Scilab/MATLAB or any equivalent open source software)

12. To obtain the simulation of single phase half wave controlled rectifier with R and RL load and plot load voltage and load current waveforms.
13. To obtain simulation of single phase fully controlled bridge rectifier and plot load voltage and load current waveform for inductive load.
14. To obtain simulation of single phase full wave ac voltage controller and draw load voltage andload current waveforms for inductive load.
15. To obtain simulation of step down dc chopper with L-C output filter for inductive load and determine steady-state values of output voltage ripples in output voltage and load current.

Text/Reference Books:

1. M.H. Rashid,"Power Electronics: Circuits, Devices & Applications", Pearson Education
2. D.W. Hart, "Introduction to Power Electronics" Prentice Hall Inc.

DEPARTMENT ELECTIVE-III

SPECIAL ELECTRICAL MACHINES

Pre-requisites of course: Electrical Machines-I & Electrical Machines-II.

Course Outcomes:		**Knowledge Level, KL**
Upon the completion of the course, the student will be able to:		
CO 1	Describe the working principle, Constructional Features of different types of electrical machines including the fractional kilowatt machines.	**K2**
CO2	Analyse torque- speed characteristics of different electrical machines and interpret their performance and identify the suitable machine for an operation.	**K4**
CO3	Study different types of control techniques for a machine and identify the best control strategy based upon different constraints.	**K4**
CO4	Illustrate the use of stepper, BLDCs, SRM, and other special machines in the area of the various industrial and domestic as well as commercial applications of various fractional kilowatt machines.	**K3**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed Syllabus:

Unit-I: Induction Machines: Concept of constant torque and constant power controls, SEIG, DFIG: Operating Principle, Equivalent Circuit, Characteristics, Applications, Linear Induction Motors. Construction, principle of operation, Linear force, and applications.

Two Phase AC Servomotors: Construction, torque-speed characteristics, performance and applications.

Unit-II: Stepper Motors: Constructional features, Principle of operation, Variable reluctance motor, Hybrid motor, Single and multistack configurations, Torque equations, Characteristics, Drive circuits, Microprocessor control of stepper motors, Closed loop control, Applications.

Unit-III: Switched Reluctance Motors: Constructional features, Rotary and Linear SRM, Principle of operation, Torque production, performance characteristics, Methods of Rotor position sensing, Sensor less operation, Closed loop control and Applications

UNIT-IV: Permanent Magnet Machines: Permanent Magnet synchronous generator Operating Principle, Equivalent Circuit, Characteristics, Permanent magnet DC motors, sinusoidal PMAC motors, their important features and applications, PCB motors,

Permanent Magnet Brushless D.C. Motors: Principle of operation, Types, Magnetic circuit analysis, EMF and torque equations, Commutation, Motor characteristics and control, Applications.

UNIT-V: Single phase synchronous motor; construction, operating principle and characteristics of reluctance and hysteresis motors;

Single Phase Commutator Motors: Construction, principle of operation, characteristics of universal and repulsion motors;

TEXT BOOKS:

1. K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
2. T.J.E Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.
3. P.S. Bimbhra "Generalized Theory of Electrical Machines" Khanna Publishers.

Reference Books:

1. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.
2. M.G. Say "Alternating current Machines" Pitman & Sons.

KOE-060 IDEA TO BUSINESS MODEL

Course Objectives:

1. This course can motivate students to have an overall idea how to start and sustain a business enterprise.
2. The students will learn basics of choosing an idea of a business model.
3. The core areas of choosing a business model are encompassed with Entrepreneurship development, PPC & communication system. The students will thus develop basic competencies how to run a business enterprise.

Unit	Topics	Lectures
I	**Introduction** Search for a business idea- How to choose an idea- Product idea- selection of product- The adoption process- Product innovation- Production , planning and development strategy- New product idea.	8
II	Introduction to Entrepreneurship - Meaning and concept of entrepreneurship- Difference between Entrepreneurship & wage employment - Functions of an Entrepreneur.- Entrepreneur vs Manager- role of entrepreneurship in economic development – Barriers to entrepreneurship.	8
III	The Entrepreneur - types of entrepreneurs- Competencies required to become an entrepreneur - Creative and Design Thinking, the entrepreneurial decision process- The process of Entrepreneurial development prog (EDP)- Evaluation of EDP - Entrepreneur development training.	8
IV	Production system- Design of production system- Types of production system- Production, planning & control (PPC) - Steps of PPC.	8
V	Communication- Importance of communication system - barriers to communication - listening to people- the power of talk - personal selling - risk taking & resilience - negotiation.	8

Text Books:

1. Entrepreneurship Development- Sangeeta Sharma, Kindle edition
2. Production & operations Management- Kanishka Bedi,
3. Marketing Management- Philip Kotler.
4. The Business Model Book: Design, build and adapt business ideas that drive business growth: Adam Bock , Gerard George

Course Outcomes: At the end of this course students will demonstrate the ability to:

1. Enhance creative knowledge of students regarding selection of a business idea and it's implementation process.
2. Acquire knowledge on entrepreneurship development, its Pro's and con's.
3. Acquire basic knowledge on how to become an Entrepreneur.
4. Develop knowledge on Production systems and it's sustainability through production, planning and control (PPC)
5. Develop appropriate business model and apply in a better way.

INDIAN TRADITIONS, CULTURAL AND SOCIETY

L: T:P: 2: 0:0

Module 1- Society State and Polity in India

State in Ancient India: Evolutionary Theory, Force Theory, Mystical Theory Contract Theory, Stages of State Formation in Ancient India, Kingship , Council of Ministers Administration Political Ideals in Ancient India Conditions' of the Welfare of Societies, The Seven Limbs of the State, Society in Ancient India, Purusārtha, Varnāshrama System, Āshrama or the Stages of Life, Marriage, Understanding Gender as a social category, The representation of Women in Historical traditions, Challenges faced by Women. Four-class Classification, Slavery.

Module 2- Indian Literature, Culture, Tradition, and Practices

Evolution of script and languages in India: Harappan Script and Brahmi Script. The Vedas, the Upanishads, the Ramayana and the Mahabharata, Puranas, Buddhist And Jain Literature in Pali,Prakrit And Sanskrit, Kautilya's Arthashastra, Famous Sanskrit Authors, Telugu Literature, Kannada Literature,Malayalam Literature ,Sangama Literature Northern Indian Languages & Literature, Persian And Urdu ,Hindi Literature

Module 3- Indian Religion, Philosophy, and Practices

Pre-Vedic and Vedic Religion, Buddhism, Jainism, Six System Indian Philosophy, Shankaracharya, Various Philosophical Doctrines , Other Heterodox Sects, Bhakti Movement, Sufi movement, Socio religious reform movement of 19th century, Modern religious practices.

Module 4-Science, Management and Indian Knowledge System

Astronomy in India, Chemistry in India, Mathematics in India, Physics in India, Agriculture in India, Medicine in India ,Metallurgy in India, Geography, Biology, Harappan Technologies, Water Management in India, Textile Technology in India ,Writing Technology in India Pyrotechnics in India Trade in Ancient India/,India's Dominance up to Pre-colonial Times

Module 5- Cultural Heritage and Performing Arts

Indian Architect, Engineering and Architecture in Ancient India, Sculptures, Seals, coins, Pottery, Puppetry, Dance, Music, Theatre, drama, Painting, Martial Arts Traditions, Fairs and Festivals, Current developments in Arts and Cultural, Indian's Cultural Contribution to the World. Indian Cinema

COURSE OBJECTIVES:

- The course aims at imparting basic principles of thought process, reasoning and inference to identify the roots and details of some of the contemporary issues faced by our nation and try to locate possible solutions to these challenges by digging deep into our past.
- To enable the students to understand the importance of our surroundings and encourage the students to contribute towards sustainable development.
- To sensitize students towards issues related to 'Indian' culture, tradition and its composite character.

- To make students aware of holistic life styles of Yogic-science and wisdom capsules in Sanskrit literature that are important in modern society with rapid technological advancements and societal disruptions.
- To acquaint students with Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.

COURSE OUTCOMES: Ability to understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.

Suggested Pedagogy for Teachers

- Project based learning
- Case studies
- Group discussion
- Presentations

Suggested Text & Reference Books

1. V. Sivaramakrishna (Ed.), *Cultural Heritage of India-Course Material*, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. S. Baliyan, *Indian Art and Culture*, Oxford University Press, India
3. Swami Jitatmanand, *Modern Physics and Vedant*, Bharatiya Vidya Bhavan
4. Romila Thapar, *Readings In Early Indian History* Oxford University Press , India
5. Fritz of Capra, Tao of Physics
6. Fritz of Capra, The wave of Life
7. V N Jha (English Translation), *Tarkasangraha of Annam Bhatta,* Inernational Chinmay Foundation,Velliarnad,Amaku,am
8. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta
9. GN Jha (Eng. Trans.) Ed. R N Jha, *Yoga-darshanam with Vyasa Bhashya*, Vidyanidhi Prakasham, Delhi,2016
10. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016
11. P R Sharma (English translation), Shodashang Hridayam
12. Basham, A.L., *The Wonder that was India* (34th impression), New Delhi, Rupa & co
13. Sharma, R.S., *Aspects of Political Ideas and Institutions in Ancient India*(fourth edition), Delhi, Motilal Banarsidass,