UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2013 SCHEME)

SYLLABUS FOR

III SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING

SCHEME -2013

III SEMESTER

ELECTRICAL AND ELECTRONICS ENGINEERING (E)

Course No	Name of subject	Credits	Weekly load, hours			C A Marks	Exam Duration Hrs	U E Max Marks	Total Marks
			L	T	D/P				
13.301	Engineering Mathematics-II (ABCEFHMNPRSTU)	4	3	1	-	50	3	100	150
13.302	Humanities (BEFMRSU)	3	3	-	-	50	3	100	150
13.303	Networks and Systems (E)	4	2	2	-	50	3	100	150
13.304	Analog Electronics (E)	4	2	2	-	50	3	100	150
13.305	DC Machines and Transformers (E)	4	2	2	-	50	3	100	150
13.306	Hydraulic Machines and Heat Engines (E)	4	2	2	-	50	3	100	150
13.307	Electronic Circuits Lab (E)	3	-	-	3	50	3	100	150
13.308	Hydraulic Machines and Heat Engines Lab (E)	3	-	-	3	50	3	100	150
	Total	**29**	**14**	**9**	**6**	**400**		**800**	**1200**

13.301 ENGINEERING MATHEMATICS - II (ABCEFHMNPRSTU)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objective:

This course provides students a basic understanding of vector calculus, Fourier series and Fourier transforms which are very useful in many engineering fields. Partial differential equations and its applications are also introduced as a part of this course.

Module – I

Vector differentiation and integration: Scalar and vector functions-differentiation of vector functions-velocity and acceleration - scalar and vector fields - vector differential operator-Gradient-Physical interpretation of gradient - directional derivative – divergence - curl - identities involving ∇ (no proof) - irrotational and solenoidal fields - scalar potential.

Vector integration: Line, surface and volume integrals. Green's theorem in plane. Stoke's theorem and Gauss divergence theorem (no proof).

Module – II

Fourier series: Fourier series of periodic functions. Dirichlet's condition for convergence. Odd and even functions. Half range expansions.

Fourier Transforms: Fourier integral theorem (no proof) –Complex form of Fourier integrals-Fourier integral representation of a function- Fourier transforms – Fourier sine and cosine transforms, inverse Fourier transforms, properties.

Module – III

Partial differential equations: Formation of PDE. Solution by direct integration. Solution of Langrage's Linear equation. Nonlinear equations - Charpit method. Homogeneous PDE with constant coefficients.

Module – IV

Applications of Partial differential equations: Solution by separation of variables. One dimensional Wave and Heat equations (Derivation and solutions by separation of variables). Steady state condition in one dimensional heat equation. Boundary Value problems in one dimensional Wave and Heat Equations.

References:

1. Kreyszig E., *Advanced Engineering Mathematics*, 9/e, Wiley India, 2013.
2. Grewal B. S., *Higher Engineering Mathematics*, 13/e, Khanna Publications, 2012.

3. Ramana B.V., *Higher Engineering Mathematics*, Tata McGraw Hill, 2007.
4. Greenberg M. D., *Advanced Engineering Mathematics*, 2/e, Pearson, 1998.
5. Bali N. P. and M. Goyal, *Engineering Mathematics*, 7/e, Laxmi Publications, India, 2012.
6. Koneru S. R., *Engineering Mathematics*, 2/e, Universities Press (India) Pvt. Ltd., 2012.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

At the end of the course, the students will have the basic concepts of vector analysis, Fourier series, Fourier transforms and Partial differential equations which they can use later to solve problems related to engineering fields.

13. 302 HUMANITIES (BEFMRSU)

Teaching Scheme: 3(L) - 0(T) - 0(P) **Credits**: 3

Course Objectives:

- *To explore the way in which economic forces operate in the Indian Economy.*
- *The subject will cover analysis of sectors, dimensions of growth, investment, inflation and the role of government will also be examined.*
- *The principle aim of this subject is to provide students with some basic techniques of economic analysis to understand the economic processes with particular reference to India.*
- *To give basic concepts of book keeping and accounting*

PART I ECONOMICS (2 periods per week)

Module – I

Definition of Economics –Central Economic Problems – Choice of techniques –Production possibility curve – Opportunity Cost-Micro & Macro Economics

Meaning of Demand – Utility-Marginal Utility and Law of Diminishing Marginal Utility-Law of demand - Determinants of Demand – Changes in Demand – Market Demand—Demand, forecasting-Meaning of supply-Law of Supply- Changes in Supply-- Market Price Determination – Implications of Government Price Fixation

Production function – Law of Variable proportion – Returns to scale – Iso-quants and Isocost line- Least cost combination of inputs – Cost concepts – Private cost and Social Cost -

Short run and Long run cost- cost curves – Revenue – Marginal, Average and Total Revenue-Break even Analysis

Module – II

National Income concepts - GNP – GDP – NNP– Per Capita Income – Measurement of National Income-Output method- Income method and Expenditure method -Sectoral Contribution to GDP– Money-Static and Dynamic Functions of Money-Inflation – causes of inflation – measures to control inflation – Demand Pull inflation – cost push inflation – Effects of Inflation – Deflation.

Global Economic Crisis India's Economic crisis in 1991 – New economic policy – Liberalization – Privatization and Globalization-Multinational Corporations and their impacts on the Indian Economy- Foreign Direct Investment (FDI) Performance of India-Issues and Concerns. Industrial sector in India – Role of Industrialization -Industrial Policy Resolutions-Industry wise analysis – Electronics – Chemical – Automobile – Information Technology.

Environment and Development – Basic Issues – Sustainable Development- Environmental Accounting – Growth versus Environment – The Global Environmental Issues- Poverty- Magnitude of Poverty in India- -Poverty and Environment

PART-II- ACCOUNTANCY (1 Period per week)

Module – III

Book-Keeping and Accountancy- Elements of Double Entry- Book –Keeping-rules for journalizing-Ledger accounts-Cash book- Banking transactions- Trial Balance- Method of Balancing accounts-the journal proper(simple problems).

Final accounts: Preparation of trading and profit and loss Account- Balance sheet (with simple problems) - Introduction to accounting packages (Description only).

References

1. Dewett K. K., *Modern Economic Theory,* S Chand and Co. Ltd., New Delhi, 2002.
2. Todaro M., *Economic Development*, Addison Wesley Longman Ltd., 1994.
3. Sharma M. K., *Business Environment in India,* Commonwealth Publishers, 2011.
4. Mithani D.M., *Money, Banking, International Trade and Public Finance*, Himalaya Publishing House, New Delhi, 2012.
5. Dutt R. and K. P. M. Sundaran*, Indian Economy,* S. Chand and Co. Ltd., New Delhi, 2002.
6. Varian H. R., *Intermediate Micro Economics,* W W Norton & Co. Inc., 2011.
7. Koutsoyiannis A., *Modern Micro-economics,* MacMillan, 2003.
8. Batliboi J. R., *Double Entry Book-Keeping,* Standard Accountancy Publ. Ltd., Bombay, 1989.
9. Chandrasekharan Nair K.G., *A Systematic approach to Accounting*, Chand Books, Trivandrum, 2010.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts. Part I and Part II to be answered in separate answer books.

Part I Economics *(70 marks) – Part I shall consist of 2 parts.*

Part A (20 Marks) - Two short answer questions of 10 marks each, covering entire syllabus. All questions are compulsory. (10x2=20marks)

Part B (50 marks) - Candidates have to answer one full question out of the two from Part I (Module I and Module II). Each question carries 25 marks.

Part II Accountancy *(30 marks)*

Candidates have to answer two full questions out of the three from Part II (Module III). Each question carries 15 marks.

Course outcome:

- *The students will be acquainted with its basic concepts, terminology, principles and assumptions of Economics.*
- *It will help students for optimum or best use of resources of the country*
- *It helps students to use the understanding of Economics of daily life*
- *The students will get acquainted with the basics of book keeping and accounting*

13.303 NETWORKS AND SYSTEMS (E)

Teaching Scheme: 2(L) - 2(T) - 0(P) **Credits**: 4

Course Objectives :

The objective of this course is to set a firm and solid foundation in Electrical Engineering with strong analytical skills and conceptual understanding of analysis and design methods in electrical and magnetic circuits, and properties of continuous and discrete time systems.

Module – I

Review of mesh analysis and node analysis. Coupled circuits – analysis of coupled circuits. Analysis of 3-phase circuits - star and delta connections, 3-wire and 4-wire systems, neutral displacement.

Dynamic circuits with periodic input: Periodic waveforms in circuit analysis. The exponential Fourier series, trigonometric Fourier series, condition for existence of Fourier series. Waveform symmetry and Fourier coefficients. Circuit applications, Average Power and RMS Values, Discrete magnitude and phase spectrum, Rate of decay of harmonic amplitude, Normalised power in a periodic waveform and Parseval's theorem, Power and power factor in AC system with distorted waveforms.

Module – II

Analysis of dynamic circuits by Laplace Transforms - The s- domain equivalent circuit, Total response of circuits using s-domain equivalent circuit, Network functions and Pole-Zero plots, Impulse response of network functions from Pole -Zero plots.

Introduction to Network Topology- Linear Oriented Graph, Incidence matrix, Kirchoff's Laws in incidence matrix formulation, Nodal analysis of networks circuit matrix of linear oriented Graph, Kirchoff's Laws in fundamental circuit matrix formulation, Loop analysis of electrical networks, The Cut-Set matrix of linear oriented graph, Kirchoff's Law in fundamental Cut-Set formulation, Node-pair analysis of networks, Analysis using generalized Branch model.

Module – III

Two Port Network and Passive Filters- Parameters of two-port network, Impedance parameters, Admittance parameters, Hybrid parameters, Transmission parameters, Relationships between parameters, Interconnection of networks conversion formulae-two port symmetry – Pi and T equivalent – Image parameter description of a reciprocal two port network. Characteristic impedance and propagation constant of symmetric T and Pi

networks under sinusoidal steady state. Introduction to filters - low pass, high pass, band pass and band elimination filters, design of constant k and m derived filters.

Module – IV

Synthesis of One-Port Network- Properties of L-C Immittance functions, Synthesis of L-C Driving-Point immittances, Properties of R-L and R-C Driving-Point immittances, Synthesis of R-C and R-L networks.

System as interconnection of elements-Introduction of continuous- time signals and discrete- time signals. Continuous time systems – Representation of continuous time systems using differential equations. Classification of continuous time systems - Static and dynamic, Causal and non-causal, Linear and non-linear, Time Invariant and time variant, Stable and non-stable, Invertible and non-invertible systems. Discrete time systems – Representation of discrete time systems using difference equations. Classification of discrete time systems - Static and dynamic, causal and non-causal Linear and non-linear, Time Invariant and time variant, Stable and non-stable systems.

References :

1. Suresh Kumar K. S., *Electric Circuits and Networks*, Pearson Education South Asia, 2009.
2. Suresh Kumar K. S., *Electric Circuit Analysis*, Pearson Education South Asia, 2013.
3. Valkenburg M. E. V., *Network Analysis*, 3/e, Pearson Education, 2006.
4. Wadhwa C. L., *Network Analysis and Synthesis*, New Age International, 2004.
5. Choudhury D. R., *Network and Systems* , New Age International Publishers, 2000.
6. *Edminister J. A., Electric Circuits,* Tata McGraw Hill, New Delhi, 2003.
7. Alexander C. K. and M. N. O. Sadiku, *Fundamentals of Electric Circuits,* 5/e, McGraw Hill Higher Education, 2007.
8. Sudhakar A. and S. P. Shyammohan, *Circuits and Networks- Analysis* and Synthesis, 3/e, Tata McGraw Hill, 2006.
9. Hayt W. H., J. E. Kemmerly and S. M. Durbin, *Engineering Circuit Analysis*, Tata McGraw Hill Education, 2012.
10. Nilson J. W., S. A. Riedel, I*ntroductory Circuits for Electrical and Computer Engineering*. Pearson Education, 2005.
11. Boylestad R. L., *Introductory Circuit Analysis,* 10/e, Pearson Education, India, 2012.
12. Oppenheim A. V., A. S Wilsky and L. T. Young, *Signals and Systems*, 2/e, Pearson, 2002.
13. Bhise G. G., *Engineering Network Analysis and Filter Design*, Umesh Publns., 1999.

14. Chakrabarti A., *Circuit Theory (Analysis and Synthesis)*, Dhanpat Rai & Sons, 2006.
15. Kuriakose C. P., *Circuit Theory: Continuous and Discrete Time Systems, Elements of Network Synthesis*, Prentice Hall of India, 2005.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

***Note:** Question paper should be set to check the analytical, design, and application skills. Descriptive questions should not exceed 20% of the maximum marks.*

Course Outcome:

Upon successful completion of this course, students will be able to analyse, design and realise various electrical networks and systems

13.304 ANALOG ELECTRONICS (E)

Teaching Scheme: 2(L) - 2(T) - 0(P) **Credits**: 4

Course Objectives:

- *To impart an in depth knowledge in electronic semiconductor devices and circuits giving importance to the various aspects of design and analysis.*
- *To provide a sound understanding of the fundamentals of operational amplifier circuits.*

Module – I

Transistor biasing and bias stability –Biasing circuits –Fixed bias, collector feedback bias and potential divider bias circuits. DC and AC load lines, Factors causing bias instability. Stability factors - design of potential divider bias (derivation for S, S_v, S_β) circuits. Bias compensation circuits - diode compensation, thermistor compensation.

Transistor modeling - h parameter equivalent circuit - graphical determination of h parameters. BJT Small signal analysis of CE amplifier at low frequencies - current gain, input impedance, voltage gain, output impedance and power gain using exact equivalent circuit. Transistor high frequency model.

Module – II

Field effect transistor - construction and characteristics of JFETs, JFET parameters, ratings and specifications. JFET bias circuits - voltage divider bias-. JFET small signal analysis of common source and common drain amplifiers.

MOSFET - Construction and characteristics of MOSFET- depletion and enhancement type, specifications. Depletion MOSFET small signal models. CMOS devices – advantages and applications.

Multistage amplifiers - RC coupled, transformer coupled and direct coupled transistor amplifiers, Darlington amplifier. General frequency considerations of single stage amplifier - Low frequency considerations, High frequency considerations - Overview of frequency response of cascaded FET amplifiers, UJT- working principle & characteristics.

Module – III

Large signal amplifiers - Classifications of amplifiers - Maximum power and efficiency of class A (series fed and transformer coupled) amplifier Class B and Class C amplifiers , Class AB, Crossover distortion. Push pull and complementary symmetry power amplifiers.

Distortion in amplifiers - causes and effect (analysis not required), series voltage regulator (with design).

Feedback amplifiers - effect of feedback, principle of negative feedback, gain and frequency response, Feedback amplifier topologies. Oscillator circuits - General theory, Barkhausen criterion for oscillation, Phase shift, Wien Bridge, Colpitts and Hartley oscillator circuits (with design). Crystal oscillator.

Module – IV

Operational Amplifiers - differential amplifier, emitter coupled differential amplifier - analysis – transfer characteristics, op-amp parameters- internal circuit of typical OP AMP IC - - gain, CMRR, offset, slew rate – drift compensation - frequency compensation- typical IC operational amplifiers – 741 & 301 comparison of 741 and 301 ICs.

Op amp circuits - inverting and non-inverting amplifiers, summer, integrator differentiator and comparator circuits - comparator IC 311 - voltage level detectors - zero crossing detectors - Schmitt trigger, logarithmic amplifier. Wave form generation - triangular and sinusoidal wave generators.

References :

1. Millman J. and C. C. Halkias, *Integrated Electronics: Analog and Digital Circuits and Systems*, Tata McGraw-Hill, 2010.
2. Boylestad R. L. and L. Nashelsky, *Electronic Devices and Circuit Theory*, 10/e, Pearson Education India, 2009.
3. Malvino A. and D. J. Bates, *Electronic Principles*, Tata McGraw Hill, 2010.
4. Floyd T. L., *Electronic Devices*, Pearson Education, 2008.
5. Bell D. A., *Electronic Devices and Circuits*, Prentice Hall of India, 2007.
6. Streetman B. G. and S. Banerjee, *Solid State Electronic Devices*, Pearson Education Asia, 2006.
7. Choudhury R., *Linear Integrated Circuits*, New Age International Publishers. 2008.
8. Gayakward R. A., *Op-Amps and Linear Integrated Circuits*, PHI Learning Pvt. Ltd., 2012.
9. Somanathan Nair B., *Electronic Devices and Applications,* Prentice Hall India, New Delhi, 2002.
10. Gopakumar K., *Design and Analysis of Electronic Circuits*, 2/e, Phasor Books, 2008.
11. Bogart (Jr.) T. F., J. S. Beasley and G. Rico, *Electronic Devices and Circuits*, 6/e, Pearson Education, 2004

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of this course, the students will have the basic knowledge of electronic devices and circuits and will be able to design, analyse and implement analog electronic circuits.

13.305 DC MACHINES AND TRANSFORMERS (E)

Teaching Scheme: 2(L) - 2(T) - 0(P) **Credits**: 4

Course Objective :

The course offers to explore the fundamental concepts underlying the working of DC machines and transformers.

Module – I

DC machines - constructional features - principle of generator and motor- Armature winding – types – DC generator - e.m.f equation. Different types of excitation. Armature reaction, effects, methods of compensation - Commutation - Open Circuit and Load Characteristics - Applications - parallel operation of dc generators.

Module – II

DC motor - production of torque - torque equation - performance characteristics - starting of dc motors. Starters - design of starter resistances. Speed control of dc motors - field control - armature control. Braking of dc motors - Losses and efficiency - Testing of dc motors -Hopkinson's test, Swinburne's test and retardation test - dc motor applications. Permanent magnet DC motors.

Module – III

Single phase transformers - principle of operation - constructional details - operation on no load – Magnetising Current phasor diagram - Equivalent circuit - transformer losses - Methods of cooling. Testing of transformers - polarity test, OC test, SC test, Sumpner's test - separation of losses - efficiency - voltage regulation - effect of load and load power factor - all day efficiency - parallel operation of transformers

Module – IV

Auto transformers - dry type transformers. 3-phase transformers - 3-phase transformer connections - choice of transformer connections - Transformer harmonics - oscillating neutral. 3-phase bank of single-phase transformers - Parallel operation of 3-phase transformers– Scott Connection - Vector groups – Three winding transformers - stabilization by tertiary winding – equivalent circuit - Tap changing transformers - no load tap changing - on load tap changing.

References:

1. Bimbra P. S., *Electrical Machinery*, 7/e, Khanna Publishers, 2006.
2. Nagarath I. J. and D. P. Kothari, *Electrical Machines,* 4/e, Tata McGraw Hill, 2010.

3. Gupta B. R. and V. Singhal, *Fundamentals of Electric Machines*, 3/e, New Age International, 2013.
4. Partab H., *Art and Utilization of Electrical Energy*, Dhanpat Rai & Sons, Delhi, 1986.
5. Clayton A. E. and N. N. Hancock, *Performance and Design of DC Machines*, ELBS/CBS Publishers, Delhi, 1992.
6. Say M. G., *Performance and Design of Alternating Current Machines*, 3/e, CBS Publishers, 2002.
7. Wildi T., *Electrical Machines, Drives and Power Systems*, Pearson Education, 2001.
8. Tharaja B. L., *A Textbook of Electrical Technology*, S. Chand & Company, New Delhi, 2008.
9. Kosow I. L., *Electric Machinery and Transformers*, 2/e, Pearson Education, 2009.
10. Murugesh Kumar K., *DC Machines and Transformers*, Vikas Publishing House Pvt. Ltd., 2004

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)
30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the successful completion of the course, the students will get a thorough knowledge in the principle of operation, construction, working, characteristics and applications of DC generators, DC motors and transformers. Also this course helps the students to study the synchronous machines and Induction machines.

13. 306 HYDRAULIC MACHINES AND HEAT ENGINES (E)

Teaching Scheme: 2(L) - 2(T) - 0(P) **Credits**: 4

Course Objective:

To impart knowledge of fluid flow problems and mechanical power generating devices which have applications in electrical engineering.

Module – I

Review of properties of fluids, Newton's law of viscosity – Intensity of pressure, pressure head–Gauge pressure, absolute pressure, measurement of pressure – Piezometer tube, manometers (simple U tube, differential and single column manometers) and mechanical gauges. Continuity equation- Bernoulli's equation (First Principle) – Application of Bernoulli's equation–Venturimeter (Horizontal, Vertical and Inclined position), Orifice meter Flow through orifices -Hydraulic coefficients of orifice. Notches (Rectangular and Triangular). Flow through pipes: Laminar and Turbulent flow, Reynolds number, Losses in pipes-Minor and Major losses. Equivalent pipes, Darcy's and Chezy's formula - Transmission of power through pipes.

Module – II

Impact of jets-series of vanes, fixed and moving curved vanes. Hydraulic turbines: Classification–Constructional features-Impulse turbines (Pelton Turbine)-Reaction turbines (Francis and Kaplan) -Velocity triangles- work done and efficiencies. Draft tubes, cavitations' - performance curves of turbines –Specific speed - governing of water turbines – Hydro electric power plant layout-penstock-surge tank.

Module – III

Pumps- Classification- Rotodynamic and Positive displacement pumps– Centrifugal pump - working , static and manometric head – work done –efficiencies – Cavitations – Characteristics curves –Specific speed –Minimum starting speed-Multi stage pumps. Positive Displacement pumps- Reciprocating pump (single acting and double acting) – indicator diagram - effect of acceleration and friction on indicator diagram. Plunger pumps-slip-volumetric efficiency. Air vessels-working and functions.

Module – IV

I C Engines – Classification - two-stroke and four stroke engines(Working) – SI and CI engines – mean effective pressure– characteristic curves - Brake power , Indicated power –

efficiencies- performance test- Morse test – Retardation test – Heat balance test. Governing of I C Engines.

Gas turbines: Classification, Ideal gas turbine cycle – work output, efficiency. Effect of Compressor and Turbine efficiency. Optimum pressure ratio for maximum specific work output. Open cycle- Analysis, simple cycle with regeneration, inter cooling, reheating. Performance of gas turbines. Comparisons of I C Engines and Gas turbines.

References:

1. Balachandran P., *Fluid Mechanics and Hydraulic Machines*, Prentice Hall India Ltd. 2011.
2. Bansal R. K., *A Textbook of Fluid Mechanics and Hydraulic Machines*, Laxmi Publications, 2005.
3. Modi P. N. and S. M. Seth, *Hydraulics & Fluid Mechanics*, S. B. H Publishers, New Delhi, 2002.
4. Rajput R. K., *Thermal Engineering*, Laxmi Publications, 2010.
5. Saleem A. S., *Hydraulic Machines and Heat Engines,* Phasor Books, 2013.
6. Ganesan V., *Fundamentals of IC engines*, Tata McGraw Hill, 2000.
7. Ganesan V., *Gas Turbines*, Tata McGraw Hill, 2003.

Internal Continuous Assessment: *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the successful completion of the course students acquire knowledge of fluid flow problems and principle and working of pumps and IC engines.

13.307 ELECTRONIC CIRCUITS LAB (E)

Teaching Scheme: 0(L) – 0(T) – 3(P) **Credits:** 3

Course Objective:

Developing skill for design and implementation of various analogue electronic circuits.

Introduction: Characteristics of silicon and germanium diode.

List of Experiments:

1. Characteristics of zener diode and zener voltage regulator series voltage regulator.
2. R-C differentiating, integrating, clipping and clamping circuits (using diodes or transistors).
3. Series voltage regulator.
4. Characteristics of an NPN transistor (CE).
5. Output and transfer Characteristics of JFET and determination of JFET parameters.
6. Design and testing of a Common Emitter amplifier – obtain its frequency response.
7. Design and testing of a common source JFET amplifier –obtain its frequency response.
8. Design and testing of R-C phase shift and Wein bridge oscillators using transistor.
9. Crystal oscillator.
10. Ramp generation using transistor circuit.
11. UJT characteristics and relaxation oscillator using UJT.
12. Study of OPAMP 741 and determination of its parameters.
13. Determination of slew rate of an OP-AMP and inverting and non-inverting amplifiers using OPAMP.
14. Simulation of wave shaping circuits, voltage regulator and CE amplifier using simulation software.

Internal Continuous Assessment *(Maximum Marks-50)*

40% - Test

40% - Class work and Fair Record

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

Questions based on the experiments No.1 to 13 in the above list. (Question based on experiment No.14 may be included as a part of the question.)

30% -- Circuit and design

30% -- Performance (Wiring, usage of equipment and trouble shooting)

20% -- Result

20%-- Viva voce

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

After successful completion of this course, the students will be capable of designing, analysing and implementing analogue electronic circuits.

13.308 HYDRAULIC MACHINES AND HEAT ENGINES LAB (E)

Teaching Scheme: 0(L) - 0(T) - 3(P) **Credits**: 3

Course Objective:

To give students practical experiences in flow problems and performances of mechanical devices

Part A Hydraulic Machines Lab:

Introduction: i) Study of gauges, meters and valves.

ii) Study of pumps and turbines.

List of Experiments:

1. Experimental determination of coefficient of discharge (C_d) and Calibrations of Orifice meter, Venturimeter and Notches- To find actual discharge for given head.
2. Determination of Darcy's coefficient of friction (f) and Chezys constant(C)-To find head loss for given length and discharge.
3. Performance tests on centrifugal pump (Single end/Double end) - To calculate specific speed at best operating condition and economic cost of running.
4. Performance tests on Plunger pump-To find slip and volumetric efficiency
5. Performance tests on Impulse and Reaction turbines- To find specific speed at best operating condition

Part B Heat Engines Lab:

Introduction: General Study on I C engines

List of Experiments:

1. Performance test on SI Engines (Hydraulic/Brake drum dynamometer), Morse Test
2. Performance test on CI Engines (Hydraulic/Brake drum dynamometer)
3. Performance test on SI/CI engine (Electrical loading)
4. Heat Balance Test on C I Engine
5. Retardation Test on C I Engine

Internal Continuous Assessment: *(Maximum Marks: 50)*

40% - Tests (final lab test)

40% - Lab work, record works, homework, assignments etc.

20% - Regularity in the class

University Examination Pattern: *(See Note given at the end)*

Examination duration: 3 hours *Maximum Total Marks: 100*

Questions based on the list of experiments prescribed.

30% - Theory, Procedure and tabular columns

30% - Conducting experiment, Observation, Tabulation with Sample calculation

15% - Graphs, Results and Inference

25% - Viva voce (based on both Part A and Part B)

Common Lab record will be used for both Hydraulic Machines Lab and Heat Engines Lab. Candidate shall submit the certified fair record for endorsement by the external examiner.

Note: Conduction of University Lab Examination:

The student will be evaluated in any one of the labs (either Hydraulic Machines lab or Heat Engines lab) for the university examination based on draw of lots. The examinations for both labs should be conducted in parallel on same days under the Chairman of Exam for third semester Mechanical Engineering.

Course Outcome:

After the successful completion of the course students will be able to understand the working of hydraulic machines such as pumps and turbines and heat engines.