E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

Accredited by NAAC with 'A' Grade | Accredited by NBA (CIVIL, CSE, ECE, EEE, IT, MECH)

NAGAPATTINAM – 611 002

Second Year – Third Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
	Program Elective – V	3	0	0	3	40	60	100
	Open Elective	3	0	0	3	40	60	100
Laboratory Course								
2104PE301	Project Work - Phase I	0	0	20	10	50	50	100
Total		**6**	**0**	**20**	**16**	**130**	**170**	**300**

Program Elective - V

Course Category	Course Name	L	T	P	C
2103PE017	**DISTRIBUTED GENERATION AND MICRO GRIDS**	**3**	**0**	**0**	**3**
2103PE018	**POWER CONVERTERS FOR SOLAR AND WIND ENERGY CONVERSION SYSTEM**	**3**	**0**	**0**	**3**
2103PE019	**APPLICATIONS OF POWER ELECTRONICS IN UTILITY SYSTEMS**	**3**	**0**	**0**	**3**
2103PE020	**COMPUTER AIDED DESIGN OF POWER ELECTRONIC CIRCUITS**	**3**	**0**	**0**	**3**

OPEN ELECTIVE COURSES

Course Category	Course Name	L	T	P	C
2103PE021	ENERGY MANAGEMENTAND AUDITING	3	0	0	3
2103PE022	RENEWABLE ENERGY TECHNOLOGY	3	0	0	3
2103PE023	ELECTRIC AND HYBRID VEHICLES	3	0	0	3
2103PE024	INDUSTRIAL CONTROL ELECTRONICS	3	0	0	3

PROGRAM ELECTIVE - V

2103PE017	**DISTRIBUTED GENERATION AND MICRO GRIDS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

PREREQUISITE:

Renewable energy resources

MODULE I	**INTRODUCTION**	**9 Hours**

Conventional power generation - Advantages and disadvantages; Energy crisis; Non - conventional energy (NCE) resources; Review of solar PV; Wind energy systems; Fuel cells; Micro turbines; Biomass; Tidal resources.

MODULE II	**DISTRIBUTED GENERATION**	**9 Hours**

Distributed generation – Description, Regulation; Compensation schemes of distributed generations; Market designs for distributed generations; Role of distributed generations in electricity market; Distributed generation optimization methods.

MODULE III	**GRID INTEGRATION**	**9 Hours**

Direct machine coupling with the grid; Distributed power electronics interface; Local control of distributed generation; Overloading of radial distribution networks; Losses & loadability; Impact of grid integration with non-conventional energy resources.

MODULE IV	**MICROGRID**	**9 Hours**

Micro grid- Components, review ,control; Control methods for a micro grid systems; Structure and configuration of micro grid; AC and DC microgrids; Power electronics interfaces in DC and AC micro grids; Modes of operation of micro grid; Communication infrastructure of micro grid; Power quality issues in micro grids; Micro grid economics.

MODULE V	**SMART GRID**	**9 Hours**

Introduction to smart grid; Functions of smart grid components; Communication measurement and monitoring technologies of smart grid; Stability analysis for smart grid; Sustainable energy options for the smart grid; Micro grid and smart grid comparison.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

Cyber security and internet of things for micro grids

REFERENCES:

1. Math Bolllen, Fainan Hassan, “Integration of distributed generation in the power system”, Wiley, IEEE press 2011.
2. Gevork B.Gharehpetian, S.Mohammad Mousavi Agah, “Distributed generation systems- Design, operation and grid integration”, Elsevier science, 2017.
3. Magdi S. Mahmoud, “Micro grid – Advanced control methods and renewable energy system integration,” Elsevier, 2017.
4. Chetan Singh Solanki, “Solar Photo Voltaics”, 3rd edition, PHI , New Delhi, 2015.
5. John Twidell and Tony Weir, “Renewable Energy Resources”, 2 nd edition, Taylor and Francis Publications, 2006.

<table>
<tr><td rowspan="2">2103PE018</td><td colspan="2" rowspan="2">POWER CONVERTERS FOR SOLAR AND WIND ENERGY CONVERSION SYSTEM</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>MODULE I</td><td>INTRODUCTION</td><td colspan="5">9 Hours</td></tr>
<tr><td colspan="7">Energy consumption; World energy scenario - Energy source and their availability, Conventional and renewable source; Need to develop new energy technologies; MNRE Rules and Regulations; TEDA; Wind and solar survey in India and World.</td></tr>
<tr><td>MODULE II</td><td>PHOTOVOLTAIC ENERGY CONVERSION</td><td colspan="5">9 Hours</td></tr>
<tr><td colspan="7">Solar radiation and measurements - Solar cells, Panels and their characteristics , Influence of insulation and temperature ; PV arrays –Maximum power point tracking, Applications; Water pumping, Street lighting; DC-DC converters for solar PV systems.</td></tr>
<tr><td>MODULE III</td><td>WIND ENERGY SYSTEMS</td><td colspan="5">9 Hours</td></tr>
<tr><td colspan="7">Basic principle of Wind Energy Conversion System ; Nature of Wind ; Components of Wind Energy ;Conversion System; Generators for WECS ; Classifications of WECS; Self excited induction generator, synchronous generator, Power conditioning schemes.</td></tr>
<tr><td>MODULE IV</td><td>GRID CONNECTED WECS AND SECS</td><td colspan="5">9 Hours</td></tr>
<tr><td colspan="7">Grid connectors ; Wind farm and its accessories ; Grid related problems; Generator control; Performance improvements; Different schemes – Matrix converters, Line commutated inverters, Multilevel inverters, Power converters for Grid connected WECS; Grid connected solar energy converter systems.</td></tr>
<tr><td>MODULE V</td><td>DISTRIBUTED POWER GENERATION SYSTEMS</td><td colspan="5">9 Hours</td></tr>
<tr><td colspan="7">Solar, PV, Hybrid Systems ; Selection of power conversion ratio; Optimization of System components ; Storage; Reliability evolution ; Types of Cogeneration processes ; Power converters for distributed power systems.</td></tr>
<tr><td colspan="7">TOTAL: 45 HOURS</td></tr>
<tr><td colspan="7">Further Reading:</td></tr>
<tr><td colspan="7">Power controllers in Combined power generation system with steam and diesel</td></tr>
<tr><td colspan="7">References:</td></tr>
<tr><td colspan="7">1. S. Rao and Parulekar, “Energy Technology – Non Conventional, Renewable and Conventional”, New Delhi, Khanna Publishers, 1999.</td></tr>
<tr><td colspan="7">2. Mukund R. Patel, “Wind and Solar Power System”, New York, CRC Press LLC, 1999.</td></tr>
<tr><td colspan="7">3. Ned Mohan, Tore M. Undeland and William P.Robbins, “Power Electronics: Converters,
4. Applications and Design” , New Jersey, John Wiley and Sons, 2003</td></tr>
<tr><td colspan="7">5. M.H. Rashid, “Power Electronics Circuits, Devices and Applications”, New Delhi, PHI, 2004.</td></tr>
<tr><td colspan="7">6. Anbu kumar kavitha, Govindarajan Uma, Experimental Verification of Hopf Bifurcation in DC-DC Luo Converter, Vol.23, No.6, IEEE Transaction on Power Electronics, 2008, pp 2878 2883.</td></tr>
</table>

2103PE019	**APPLICATIONS OF POWER ELECTRONICS IN UTILITY SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
MODULE I	**INTRODUCTION**				**9 Hours**
High Power drives for Power systems controllers –Characteristics– Converters Configuration for Large power control.					
MODULE II	**SINGLE PHASE AND THREE PHASE CONVERTERS**				**9 Hours**
Properties–Current and voltage harmonics–Effect of source and load impendence – Choice of best circuit for power systems-Converter Control-Gate Control–Basic means of Control –Control characteristics–Stability of control–Reactive power control – Applications of converters in HVDC systems–Static VAR control- Source of reactive power–Harmonics and filters.					
MODULE III	**HVDC**				**9 Hours**
HVDC configurations, components of HVDC system: Converter, transformer, smoothing reactor, harmonic filter. Reactive power support, operation of 6-pulsecontrolledrectifierininvertingmodeofoperation.Operation of12- pulse converter. Control of HVDC system, Rectifier and inverter characteristics, mode stabilization, current control, voltage dependent current order limit, combined rectifier-inverter characteristics, valve blocking and by- passing, limitations HVDC system using line commutated converters, modern HVDC system – HVDC light.					
MODULE IV	**REACTIVE POWER COMPENSATION**				**9 Hours**
Introduction, methods of var generation, analysis of uncompensated AC line, Passive reactive power compensation, Compensation bya series capacitor connected at the midpoint of the line, Effect on Power Transfer capacity, Compensation by STATCOM and SSSC, Fixed capacitor-Thyristor controlled reactor(FC- TCR),Thyristor -switched capacitor- Thyristor controlled reactor(TSC-TCR), static var compensators**.**					
MODULE V	**STATIC APPLICATIONS**				**9 Hours**
Static excitation of synchronous generators-Solid state tap changers for transformer-UPS Systems-Induction furnace control.					
					TOTAL: 45 HOURS

REFERENCES:

1. K.R.Padiyar, HVDC Power Transmission System–Technology and System Interaction, New Delhi, New Age International, 2002.
2. Erich Uhlmann, Power Transmission by Direct Current, New York, Springer Publications, 1975.
3. E.W.Kimbark, Direct Current Transmission, Vol.1, NewYork, Wiley Interscience, 1971.
4. Ned Mohan, Power Electronics Converters Applications and Design, New York, John Wiley and Sons, 2002.
5. D.V.Hall, Elements in Microprocessor & Interfacing:-Programming and Hardware, New York, McGraw-Hill, 1992.
6. Mohd Hasan Ali, Bin Wu, Roger A. Dougal, An Overview of SMES Applications in Power and Energy Systems, IEEE Transactions on Sustainable Energy,vol.1,no.1, April2010
7. Marcelo Gustavo Molina, Pedro Enrique Mercado, Edson Hirokazu Watanabe, Improved Superconducting Magnetic Energy Storage(SMES) Controller for High-Power Utility Applications, IEEE Transactions on EnergyConversion,vol.26,no.2,June2011.

2103PE020	**COMPUTER AIDED DESIGN OF POWER ELECTRONIC CIRCUITS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
MODULE I	**INTRODUCTION**				**9 Hours**
Importance of simulation; General purpose circuit analysis; Methods of analysis of power electronic systems; Review of power electronic devices and circuits.					
MODULE II	**ADVANCED TECHNIQUES IN SIMULATION**				**9 Hours**
Analysis of power electronic systems in sequential manner–coupled and decoupled systems; Various algorithms for computing steady state solution in power electronic systems; Future trends in computer simulation.					
MODULE III	**MODELING OF POWER ELCTRONIC DEVICES**				**9 Hours**
Introduction to AC sweep and DC sweep analysis; Transients and the time domain analysis; Fourier series and harmonic components; BJT, FET, and MOSFET and its model; Amplifiers and oscillators; Non-linear devices.					
MODULE IV	**SIMULATION OF CIRCUITS**				**9 Hours**
Introduction to schematic capture and libraries; Time domain analysis; System level integration and analysis; Monte Carlo analysis; Sensitivity/stress analysis; Fourier analysis.					
MODULE V	**CASE STUDIES**				**9 Hours**
Simulation of Converters, Choppers, Inverters, AC voltage controllers, and Cyclo- converters feeding R, R-L and R-L-E loads; Computation of performance parameters- Harmonics, power factor, angle of overlap.					
					TOTAL: 45 HOURS

References:

1. Rashid, M., “Simulation of Power Electronic Circuits using Pspice”, PHI, 2006.
2. Rajagopalan, V, “Computer Aided Analysis of Power Electronic Systems” Marcell–Dekker Inc., 1987.
3. John Keown, “Microsim, Pspice and Circuit Analysis”, Prentice Hall Inc., 1998.
4. https://nptel.ac.in/courses/108104048
5. https://esim.fossee.in/

OPEN ELECTIVE COURSES

2103PE021	ENERGY MANAGEMENT AND AUDITING	L	T	P	C
		3	0	0	3

MODULE I	**INTRODUCTION**	**9 Hours**
Fundamentals of energy, Various types of energy - Potential energy, Kinetic energy; Commercial and non-commercial energy, Grades of energy, Energy demand and supply in India, Energy scenario in India, Energy security in India, Future energy strategy.		
MODULE II	**ENERGY MANAGEMENT AND ENERGY CONSERVATION OPPORTUNITIES**	**9 Hours**
Energy management - Energy Management Techniques, Importance of energy management, Energy economics - Discount rate, Payback period, Internal rate of return, Life cycle costing. Energy conservation - Energy conservation and opportunities in households, in industrial sector and in lighting; Energy saving opportunities in HVAC, Bureau of Energy Efficiency (BEE) – Role and its significance in energy conservation.		
MODULE III	**ENERGY EFFICIENCY IN ELECTRICAL SYSTEMS**	**9 Hours**
Electrical system - Electricity billing, Electrical load management and maximum demand control, Power factor improvement and its benefit, Selection and location of capacitors, Performance assessment of PF capacitors, Distribution and transformer losses. Electric motors - Types, Losses in induction motors, Motor efficiency, Factors affecting motor performance, Rewinding and motor replacement issues, Energy saving opportunities with energy efficient motors.		
MODULE IV	**ENERGY AUDIT**	**9 Hours**
Concept of energy audit, Type of energy audit - Preliminary energy audit methodology, Detailed energy audit methodology; Collecting data strategy, Technical and economic feasibility, Understanding energy costs - Fuel costs, power costs; Benchmarking and energy performance, Plant energy performance, Electrical energy auditing and saving techniques in an educational institution (case study).		
MODULE V	**ENERGY ACTION PLANNING**	**9 Hours**
Energy management system - Support and commitment of the top management, Energy manager appointment, Dedicated energy team formation, Establishment of energy policy, Performance of energy assessment, Goals setting in an energy management organization, Formulation of an action plan, Implement and execution of action plan, Process of evaluating progress, Achievement recognition.		
TOTAL: 45 HOURS		

FURTHER READING:

	1. Energy audit instruments
	2. Economic analysis and project planning techniques.

REFERENCES:

1. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, “Guide to Energy Management”, 5th Edition, The Fairmont Press, Inc.,2008
2. Easton T.D and Croft D.R, “Energy Efficiency for Engineers and Technologists”, Longman Scientific & Technical,1990.
3. Reay D.A, “Industrial Energy Conservation”, 1st Edition, Pergamam Press,1977.
4. “IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities”, IEEE,1996.
5. BarneyL.Capehart,WayneC. Turner, WilliamJ.Kennedy,“GuidetoEnergyManagement”,5th Edition, The Fairmont Press, Inc.,2006.
6. https://beeindia.gov.in/sites/default/files/1Ch3.pdf
7. https://www.digimat.in/nptel/courses/video/108107113/L36.html

2103PE022	RENEWABLE ENERGY TECHNOLOGY	L	T	P	C
		3	0	0	3

MODULE I	**BASICSOFSOLAR ENERGY**	**9 Hours**
Sun and earth, Basic characteristics of solar radiation, Angle of sunrays on solar collector, Photovoltaic cell, Characteristics and equivalent circuit, Photovoltaic modules and arrays.		
MODULE II	**PHOTOVOLTAIC SYSTEMS**	**9 Hours**
PV systems - Design of PV systems, Standalone system with DC/AC loads and with/without battery storage, Grid connected PV systems, Maximum Power Point Tracking.		
MODULE III	**WIND ENERGY SYSTEMS**	**9 Hours**
Wind energy – Energy in the wind, Aerodynamics, Rotor types, Forces developed by blades, Aerodynamic models, Braking systems, Tower, Control and monitoring system, Design considerations, Power curve, Power speed characteristics, Choice of electrical generators.		
MODULE IV	**WIND ENERGY CONVERSION SYSTEMS**	**9 Hours**
Wind turbine generator systems: Fixed speed induction generator - Performance analysis; Semi variable speed induction generator, Variable speed induction generators with full and partial rated power converter topologies, Isolated systems, Self-excited induction generator, Permanent magnet alternator, Performance analysis.		
MODULE V	**HYBRID ENERGY SYSTEMS**	**9 Hours**
Hybrid energy systems – Wind - Diesel system, Wind - PV system, Micro hydro - PV system, Biomass - PV - Diesel system, Geothermal-Tidal and OTEC systems		
		TOTAL: 45 HOURS

FURTHER READING:

Case studies on available, tapping and utilization of alternate energy sources in India.

REFERENCES:

1. Chetan Singh Solanki, 'Solar Photovoltaics -Fundamentals, Technologies and Applications', PHI Learning Pvt. Ltd., New Delhi, 2011.
2. Van Overstraeton and Mertens R.P., 'Physics, Technology and use of Photovoltaics', Adam Hilger, Bristol, 1996.
3. John F.Walker& Jenkins. N, 'Wind energy Technology', John Wiley and sons, Chichester, UK, 1997.
4. Freries LL ,'Wind Energy Conversion Systems', Prentice Hall, U.K., 1990

2103PE023	**ELECTRIC AND HYBRID VEHICLES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
MODULE I	**ELECTRIC VEHICLES**				**9 Hours**
History of modern transportation; Introduction to electric vehicles; History of EVs, hybrid electric vehicles and fuel cell vehicles; Solar based EVs; Social, environmental importance and key challenges of hybrid and electric vehicles.					
MODULE II	**ENERGY STORAGE AND BATTERY TECHNOLOGY**				**9 Hours**
Introduction to energy storage system; Battery requirements for HEVs, PHEVs, and EVs; Types of batteries; Properties of batteries; Working principle and construction of lead-acid, nickel cadmium, nickel metal hydride, lithium ion Batteries; Maintenance and charging of batteries; Diagnosing lead-acid battery faults; Advanced battery technology; Developments in electrical storage; Flow batteries; Hybridization of energy storage systems; Case studies.					
MODULE III	**CHARGING AND STARTING SYSTEMS**				**9 Hours**
Requirements of the charging system; Charging system principles; Alternators and charging circuits; Diagnosing charging system faults; Advanced charging system technology; New developments in charging systems; Requirements of the starting system; Starter motors and circuits; Types of starter motor; Diagnosing starting system faults; Advanced starting system technology; New developments in starting systems; Case studies.					
MODULE IV	**ELECTRIC PROPULSION SYSTEMS**				**9 Hours**
Electric motors used in EVs; DC motor drives, Induction motor drives, PMBLDC motor drives, SRM drives – Principle and modes of operation, Speed control and performance characteristics.					
MODULE V	**EMERGING TECHNOLOGIES**				**9 Hours**
Introduction-Electric vehicle supply equipment, Smart vehicles in smart grid; Vehicle-to-grid technologies-Unidirectional and bidirectional; Need of charging station selection (CSS) server, Smart grid technologies-Applications / benefits, smart meter, smart charger; Purpose and benefits; Ethics in road safety.					
					TOTAL: 45 HOURS
FURTHER READING:					
	1. Wireless charging of electric vehicles.				
	2. Monitoring and control of driverless electric vehicle.				

REFERENCES:

1. M. Ehsani, Y. Gao, and A. Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, Second Edition, 2009.
2. Tom Denton, “Automobile Electrical and Electronic Systems”, Elsevier Butterworth-Heinemann, Fourth Edition, 2011.
3. Ali Emadi, “Advanced Electric Drive Vehicles”, CRC Press, First Edition, 2014.
4. Iqbal Hussain, “Electric & Hybrid Vehicles – Design Fundamentals”, Second Edition, CRC Press, 2011.
5. James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, Second Edition, 2015.
6. NPTEL Course, “Historical Journey of Hybrids and Electric Vehicle”, by Dr. Praveen Kumar and Prof. S. Majhi,IIT-Guwahati.

2103PE024	INDUSTRIAL CONTROL ELECTRONICS	L	T	P	C
		3	0	0	3

MODULE I	**UPS AND STORAGE SYSTEMS**	**9 Hours**
Review of uninterrupted power supplies, Offline and on-line topologies, Analysis of UPS topologies, Solid state circuit breakers and Solid-state tap changing of transformer; Advanced energy storage systems – Advanced chemistry batteries, Ultra-capacitors, Flywheel energy storage, Fuel cells characteristics and applications.		
MODULE II	**SENSORS**	**9 Hours**
Overview of sensors in industrial applications, Current sensors, Current transformer, Hall effect sensors, Voltage sensors, Non-isolated measurement, Hall effect, Temperature sensors, Thermal protection of power components, Speed sensors, Position sensors.		
MODULE III	**CONTROLLERS AND SIGNAL CONDITIONERS**	**9 Hours**
Analog controllers – P, PI and PID controllers, Derivative overrun, Integral windup, Cascaded control, Feed forward control. **Signal conditioners -** Instrumentation amplifiers, Voltage to current, Current to voltage, Voltage to frequency, Frequency to voltage converters.		
MODULE IV	**SOLID STATE CONTROL**	**9 Hours**
Solid state welding power source - Introduction, Classification, Basic characteristics, Volt ampere relationship and its measurements, Control of volt ampere characteristics, Volt control, Slope control and Dual control, Pulsing techniques, Testing of welding power source; Introduction to heating, Classification, Characteristics, Applications.		
MODULE V	**PLC AND SCADA SYSTEMS**	**9 Hours**
Introduction to programmable logic controllers, Architecture, Programming. Supervisory Control and Data Acquisition (SCADA) systems, Components of SCADA systems, SCADA basic functions, SCADA application functions in electrical engineering, Energy saving in electrical drive systems.		
		TOTAL:45 HOURS
FURTHER READING:		
	Applications of Stepper and Servo Motors with its controllers in food packaging industries- A Case Study.	
REFERENCES:		

1. J Michael Jacob, “Industrial Control Electronics – Applications and Design”, Prentice Hall, 1995.
2. E. Kissell, “Industrial Electronics”, 3rd Edition, Prentice Hall India, 2003
3. Curtis D. Jhonson, “Process Control Instrumentation technology”, 8th Edition, Pearson New International, 2014.
4. Mehrdad Ehsani, Yimin Gao, Sebastian E. Gay, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles-Fundamentals, Theory and Design”, 2nd Edition, CRC Press, 2004.
5. Welding Handbook, Volume-2, 7th Edition, American Welding Society.
6. Power Electronics Applied to Industrial Systems and Transports. Volume 5: Measurement Circuits, Safeguards and Energy Storage, Imprint - ISTE Press – Elsevier.

2104PE301	**PROJECT WORK - PHASE I**	**L**	**T**	**P**	**C**
		0	**0**	**20**	**16**

Course Objectives

1. To develop skills to formulate a technical project.
2. To give guidance on the various tasks of the project and standard procedures.
3. To teach use of new tools, algorithms and techniques required to carry out the projects.
4. To give guidance on the various procedures for validation of the product and analyses the cost effectiveness.
5. To provide guidelines to prepare technical report of the project.

Course Outcomes (COs)

After completion of the course, students will be able to

CO1 Formulate a real world problem, identify the requirement and develop the design solutions

CO2 Identify technical ideas, strategies and methodologies

CO3 Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project

CO4 Perform test and validate through conformance of the developed prototype

CO5 Analysis the cost Effectiveness of the project

CO6 Explain the acquired knowledge through preparation of report and oral presentations

GUIDELINE FOR REVIEW AND EVALUATION

The student will be work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report has to be submitted by the student with the fabricated model, which will be reviewed and evaluated for internal assessment by a committee constituted by the head of the department. At the end of the semester examination, the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the head of the department