

# GRADUATE ATTRIBUTE RUBRICS

FACULTY OF ENGINEERING



Maharaja Institute of Technology Mysore

Belawadi, Naguvanahalli Post, Srirangapatna Taluk, Mandya-571 477

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(Approved by AICTE, Affiliated to VTU, Belagavi, and Recognized by Govt. of Karnataka)

## **FOREWORD**

Rubrics are used for communicating the performance expectations for any activity. They are ways to provide transparent criteria for assessment for all stakeholders (faculty, instructors, students, alumni and Industry). Rubrics are descriptive, and thereby can be used as a tool to promote understanding, and to direct future instruction and learning. They can as well be used for self and peer evaluation.

The primary aims of rubrics are to, Define foci and/or indicators for each graduate attribute; Divide each indicator into four performance levels; Target the level that indicates student competency.

Rubrics are a tool conducive to outcomes-based education and assessment, a guiding principle for NBA accreditation. The Faculty of Engineering Graduate Attribute Rubrics can be used to facilitate a common understanding and language for engineering stakeholders (faculty, instructors, students, alumni and Industry) regarding the twelve NBA graduate attributes. They are intended as a pedagogical assessment tool for use by instructors of individual courses, as well as for assessment at the program level, as applicable.

I congratulate the team of faculty for having penned down ‘The Faculty of Engineering Graduate Attribute Rubrics’ and urge all concerned to make best possible use of it to ensure continuous improvement in all sphere of academics.

**Dr. Naresh Kumar B G**  
**Principal**

## **ACKNOWLEDGEMENTS**

The Faculty of Engineering Graduate Attribute Rubrics is intended as a pedagogical assessment tool for use by course instructors of individual courses, as well as for assessment at the program level, as applicable.

The development of this document was initiated by the institute with an objective of defining foci and indicators identified as elements encompassed within the stated graduate attributes.

Similar document that bears the copyright of University of Manitoba (United States of America) is acknowledged to have contributed immensely in preparation of this document.

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Sincere thanks and great regards are duly extended to Dr. Naresh Kumar B G, Principal, and the Members of the Management of the Institute.

**Godfrey Devaputra**

**Convener- NBA Works**

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.					
Focus Areas	Indicators	Level 4	Level 3	Level 2	Level 1
		Strong	Competent	Developing	Needs Work
Knowledge Base for Engineering	<b>Mathematical and Scientific Terms:</b> Interpret and apply scientific and mathematical terms.	Demonstrates a skilful ability to interpret mathematical and scientific terms correctly.	Demonstrates an ability to interpret most mathematical and scientific terms correctly.	Demonstrates some ability to interpret mathematical and scientific terms correctly.	Demonstrates minimal or no ability to interpret mathematical and scientific terms correctly.
	<b>Theory in Engineering Problems:</b> Ability to interpret and apply theory in engineering problems.	Demonstrates a comprehensive Understanding of underlying theory and application to the problem.	Demonstrates an ability to Understand the application of theory to the problem.	Demonstrates some ability to Understand the application of theory to the problem.	Demonstrates minimal or no ability to Understand the application of theory to the problem.
	<b>Mathematical Models:</b> Ability to apply mathematical models to engineering problem and/or formulate engineering models.	Chooses an optimal mathematical model that applies to an engineering problem, and develops new models.	Chooses a mathematical model that applies to an engineering problem, and has some success in model development.	Chooses a mathematical model that applies to an engineering problem, but requires assistance in model development.	Demonstrates minimal or no Understanding of the connection between mathematical models and engineering problems.

**PO2: Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.**

Focus Areas	Indicators	Level 4 Strong	Level 3 Competent	Level 2 Developing	Level 1 Needs Work
Problem Solving	<b>Identify/Define and Contextualize Problem:</b> Ability to identify and/or articulate a problem.	Demonstrates a skilful ability to identify/articulate a problem that is <b>strongly supported and clearly linked</b> to the issues at hand and demonstrates a comprehensive and insightful understanding	Demonstrates ability to identify/articulate a problem that is <b>clearly linked</b> to the issues at hand.	Demonstrates some ability to identify / articulate a problem that is <b>partially connected</b> to the issues at hand.	Demonstrates <b>minimal or no ability</b> to identify/articulate a problem.
	<b>Formulate Strategies for Solving a Problem:</b> Ability to identify strategies for solving problems (brainstorming, research, trial and error).	Demonstrates a <b>skilful ability</b> to identify multiple strategies for generating approaches to solve a problem, and has insight into the pros and cons of those strategies.	Demonstrates an <b>ability to identify</b> an appropriate strategy for generating approaches for solving a problem.	Demonstrates <b>some ability</b> to identify a strategy for generating an approach for solving the problem. Strategy may or may not be appropriate.	Demonstrates <b>minimal or no ability</b> to identify a strategy for generating an approach for solving a problem.
	<b>Analyze, Evaluate and Select Solutions:</b> Ability to analyze, evaluate and select optimal/practical Solution, including feasibility and impact.	Demonstrates a skilful ability to analysis, evaluate and select optimal/practical solution, <b>thorough and insightful</b> explanation of feasibility and impact.	Demonstrates an ability to analyze, evaluate and select optimal/practical solution. <b>Clear explanation</b> of feasibility and impact.	Demonstrates some ability to analyze, evaluate and select optimal/practical solution. <b>Partial explanation</b> of feasibility and impact.	Demonstrates minimal or no ability to analyze, evaluate or select optimal/practical solution. <b>No explanation</b> of feasibility and impact.

**PO 3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations**

Focus Areas	Indicators	Level 4	Level 3	Level 2	Level 1
		Strong	Competent	Developing	Needs Work
Design Process	<b>Understanding the Design Process:</b> Ability to explain the design process including the importance of needs, specifications, concept generation, selection and evaluation.	Demonstrates a comprehensive ability to understand and explain a design process.	Demonstrates an ability to understand and explain a design process.	Demonstrates some ability to understand and explain a design process.	Demonstrates minimal or no ability to understand and explain a design process.
	<b>Problem Solving:</b> <b>Considering Solutions:</b> <i>Ability to develop an approach to solve a problem.</i>	Considers multiple approaches to solving a problem, and develops a logical, consistent plan. Recognizes consequences of solution and can articulate reason for choosing solution.	Considers multiple approaches to solving a problem, which is justified and considers consequences.	Considers a few approaches to solving a problem; doesn't always consider consequences.	Considers a single approach to solving a problem. Does not consider consequences.
	<b>Implementing Design Strategy:</b> <i>Ability to execute a solution to an open-ended problem taking into consideration design requirements and pertinent contextual elements.</i>	Demonstrates a skilful (thorough/insightful/creative) ability to execute a solution taking into consideration all design requirements and pertinent contextual elements.	Demonstrates an ability to execute a solution taking into consideration design requirements and some contextual elements.	Demonstrates some ability to execute a solution that attends to the problem, but omits some design requirements and/or pertinent contextual elements.	Demonstrates minimal or no ability to execute a solution. Solution does not directly attend to the problem.
	<b>Evaluating Final Design:</b> <i>Ability to evaluate/confirm the functioning of the final design.</i>	Demonstrates a skilful (thorough/insightful) ability to evaluate/confirm the	Demonstrates an ability to evaluate/confirm the functioning of the final design. The evaluation is	Demonstrates some ability to evaluate/confirm the functioning of the final design, but the evaluation	Demonstrates minimal or no ability to evaluate/confirm

		functioning of the final design, with deliberation for further improvement.	complete and has sufficient depth.	lacks depth and/or is incomplete.	m the functioning of the final design.
Creative Thinking	<b>Innovation:</b> <i>Ability to recognize and incorporate innovation when considering an idea.</i>	Demonstrates a comprehensive recognition and incorporation of innovation when considering an idea.	Demonstrates an ability to recognize and incorporate innovation when considering an idea.	Demonstrates some recognition and incorporation of innovation when considering an idea.	Demonstrates minimal or no recognition of innovation when considering an idea.
	<b>Connecting and Integrating:</b> <i>Ability to connect, integrate and transform ideas into solutions.</i>	Demonstrates a skillful ability to connect, integrate and transform innovative ideas into innovative solutions.	Demonstrates an ability to connect, integrate and transform ideas into solutions.	Demonstrates some ability to connect, integrate and transform ideas into solutions.	Demonstrates minimal or no ability to connect, integrate and transform ideas into solutions.
<b>PO 4: Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions</b>					
Focus Areas	Indicators	Level 4 Strong	Level 3 Competent	Level 2 Developing	Level 1 Needs Work
Experimental /Theoretical Methods	<b>Lab Preparation:</b> <i>Ability to gather materials and record on lab report.</i>	Exemplary materials are gathered and recorded on the lab report with clarity and concision.	All required materials are gathered and recorded on the lab report. The selected materials are suitable for the procedure.	Most required materials are gathered; not all may be recorded on the lab report. The selected materials are adequate for the procedure.	All required materials are not gathered, nor recorded on the lab report. The selected materials are not all adequate



					and/or suitable for the procedure.
	<b>Purpose:</b> <i>Ability to state the hypothesis and the research question, clarify the connection between them, and identify the variables.</i>	The hypothesis and research question are skilfully specified, and the connection between the two is <b>explained in depth</b> . The variables are identified and discussed.	The hypothesis and research question are specified clearly, and the connection between the two is <b>explained</b> . The variables are identified.	The hypothesis and research question are specified, and the connection between the two is <b>somewhat clear</b> . Most variables are identified.	The hypothesis and research question are <b>not specified clearly</b> , and the connection between the two is vague or missing. Most variables are not identified.
	<b>Procedure:</b> <i>Ability to follow experimental procedures, control variables, and record procedural steps on lab report.</i>	The procedure is efficiently followed and student skilfully controls all chosen variables. All procedural steps are <b>clearly and concisely</b> recorded on lab report.	The procedure is well followed and student demonstrates control of all chosen variables. <b>All procedural steps are recorded</b> on the lab report.	The procedure could be better followed, but student controls all chosen variables. <b>Most procedural steps</b> are recorded on the lab report.	The procedure is inadequately followed, and student does not control chosen variables. <b>Many procedural steps are not entered</b> on the lab report.
	<b>Data/Evidence Collection:</b> <i>Ability to record raw data/evidence.</i>	Raw data/evidence, as well as units, are skilfully recorded. The data table is clearly and <b>concisely, and/or creatively</b>	Raw data/evidence, as well as units, are appropriately and clearly recorded. The data table is <b>appropriately</b>	Raw data/evidence, as well as units, are recorded although not as clearly or suitably as they might be. The data table	Raw data/evidence, as well as units, are not

		labelled and formatted.	labelled and formatted.	may lack appropriate labels and/or format.	recorded suitably. The data table is not labelled and/or formatted.
	<b>Data Presentation and Error Analysis:</b> <i>Ability to present data using charts, tables and/or graphs to enable comprehension and interpretation, including error analysis.</i>	Data are presented in ways to best enable comprehension and interpretation, skilfully incorporating error analysis.	Data are presented in ways to enable comprehension and interpretation, incorporating error analysis.	Data are presented in ways that somewhat aid comprehension and interpretation and incorporate error analysis, but presentation could be clearer.	Data are not presented clearly. Error analysis is wrong or missing.
	<b>Evaluation of Experiment:</b> <i>Ability to interpret findings, compare them to values in the literature, identify weaknesses and limitations, and propose improvements.</i>	The findings are interpreted insightfully and skilfully compared with values in the literature. Weaknesses and limitations are analyzed and creative recommendations are made to address them.	The findings are interpreted and compared with values in the literature. Weaknesses and limitations are considered and recommendations are made to address them.	The findings are interpreted and compared with values in the literature, but not as fully or clearly as they might be. Not all of the weaknesses or limitations are discussed; few recommendations are made to address them.	The interpretation of the findings is illogical, and the findings are not compared with values in the literature. Few or no weaknesses or limitations are discussed; few or no recommendations are made to address them.

Examination and Evaluation	<b>Identifying Problems for Investigation:</b> <i>Ability to identify problems/ issues/ topics for investigation.</i>	Identifies relevant problems/issues/topics with minimal or no orientation, and is able to select those that are pertinent/critical for investigation.	Identifies relevant problems/issues/topics with minimal orientation, that require investigation.	Some ability to identify problems/issues/topics that may or may not require investigation.	Minimal or no ability to identify problems/issues/topics that may or may not require investigation.
	<b>Conclusions and Recommendations</b> <i>Ability to state conclusions and make recommendations as a result of the investigation.</i>	States logical conclusions and makes insightful recommendations, and identifies those that are pertinent /critical.	States logical conclusions and makes appropriate recommendations.	States conclusions and makes recommendations that may or may not be relevant to the investigation.	Minimal or no ability to state conclusions or make recommendations.
	<b>Limitations and Implications:</b> <i>Ability to identify limitations and implications.</i>	Identifies all significant limitations and implications.	Identifies many important limitations and implications.	Identifies some limitations and implications.	Minimal or no ability to identify limitations or implications.

**PO 5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.**

Focus Areas	Indicators	Level 4 Strong	Level 3 Competent	Level 2 Developing	Level 1 Needs Work
Use of Engineering Tools	<b>Understand Tools:</b> <i>Ability to describe and explain the principles behind and applicability of engineering tools.</i>	Demonstrates skilful ability to describe and explain the principles behind and applicability of engineering tools.	Demonstrates ability to describe and explain the principles behind and applicability of	Demonstrates some ability to describe and/or explain the principles behind and applicability of	Demonstrates minimal or no ability to describe and/or explain the principles behind and applicability of engineering

			engineering tools.	engineering tools.	tools.
	<b>Identify and Use Tools:</b> <i>Ability to identify and use relevant tools for an engineering activity.</i>	Demonstrates skilful ability to identify and use the most relevant tools for a range of engineering activities.	Demonstrates an ability to identify and use relevant tools for an engineering activity.	Demonstrates some ability to identify and use tools for an engineering activity, but may not identify the most relevant tool.	Demonstrates minimal or no ability to identify or use tools for an engineering activity.
	<b>Evaluate Tools:</b> <i>Ability to identify the limitations in the use of engineering tools, and their underlying assumptions.</i>	Demonstrates skilful ability to evaluate the limitations of tools and discusses the assumptions.	Demonstrates the ability to identify the limitations of tools and understands the assumptions.	Demonstrates some ability to identify the limitations of tools and some understanding of the assumptions.	Demonstrates minimal or no ability to identify the limitations of tools and understand the assumptions.
<b>PO 6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.</b>					
Focus Areas	Indicators	Level 4 Strong	Level 3 Competent	Level 2 Developing	Level 1 Needs Work
Professionalism	<b>Considers Diverse Perspectives:</b> <i>Ability to consider other cultural, disciplinary, and ethical perspectives when investigating engineering impact on society and environment.</i>	Considers, explains and evaluates multiple diverse perspectives when investigating engineering impact on society and environment.	Considers and explains multiple diverse perspectives when investigating engineering impact on society and environment.	Some consideration of diverse perspectives when investigating engineering impact on society and environment.	Minimal consideration of diverse perspectives when investigating engineering impact on society and environment.

PO 7: Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.					
Impact of Engineering on Society and the Environment	<b>Solutions for Societal and Environmental Challenges:</b> <i>Ability to identify solutions to challenges in society and the environment.</i>	Identifies, explains and evaluates multiple solutions to challenges in society and the environment.	Identifies and explains multiple solutions to challenges in society and the environment.	Identifies some solutions to challenges in society and the environment.	Minimal or no ability to identifying solutions to challenges in society and the environment.
	<b>Personal and Collective Responsibility:</b> <i>Ability to recognize the individual and collective responsibility of engineering and its interventions on society and the environment.</i>	Recognizes the responsibility of engineers and evaluates the consequences of engineering interventions on society and environment.	Recognizes the responsibility of engineers and identifies the consequences of engineering interventions on society and environment.	Some recognition of the responsibility of engineers and the consequences of engineering interventions on society and environment.	Minimal or no recognition of the responsibility of engineers and the consequences of engineering interventions on society and environment.
PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.					
Ethics	<b>Ethical Recognition and Behaviour:</b> <i>Ability to recognize and act on ethical issues (personal, professional and corporate).</i>	Approaches all situations with awareness and consideration of the ethical issues involved, and actively work to resolve them.	Able to approach situations with consideration of ethical issues, and acts to resolve them.	Some ability to approach situations with consideration of ethical issues, and/or some ability to act to resolve them.	Minimal or no ability to approach situations with consideration of ethical issues.
	<b>Equity:</b> <i>Ability to recognize equitable issues (ethnicity, gender, age, sexual orientation, faith, geography, socio-economic status, etc.), and acts/ behaves with inclusivity.</i>	Approaches all situations with consideration of equitable issues involved, and actively behave with inclusivity.	Able to approach situations with consideration of equitable issues, and acts with inclusivity.	Some ability to approach situations with consideration of equitable issues, and behaves with some regard for inclusivity.	Minimal or no ability to approach situations with consideration of equitable issues.
	<b>Accountability:</b>	Always assumes	Assumes responsibility	Recognizes the need to	Minimal or no ability to

	<i>Recognizes the need to assume responsibility for own actions.</i>	responsibility for own actions.	for own actions.	assume responsibility for own actions, but may not always act on this recognition.	recognize the need to assume responsibility for own actions. May blame others for own issues and problems.
	<b>Proper Use of Others' Work:</b> <i>Ability to recognize, understand and apply proper ethical use of intellectual property, copyrighted materials, and research.</i>	Always recognizes and applies proper ethical use of intellectual property, copyrighted materials, and others' research.	Recognizes and applies proper ethical use of intellectual property, copyrighted materials, and others' research.	Some recognition and application of proper ethical use of intellectual property, copyrighted materials, and others' research.	Minimal or no recognition and/or application of proper ethical use of intellectual property, copyrighted materials, or others' research.
<b>PO 9: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.</b>					
<b>Individual Contributions Within a Team</b>	<b>Individual Idea Contributions:</b> <i>Ability to contribute useful ideas to advance work of team.</i>	Routinely contributes useful ideas to advance the work of team.	Contributes useful ideas to advance the work of the team.	Sometimes contributes useful ideas to advance work of team.	Rarely contributes useful ideas to advance the work of the team.
	<b>Individual Work Contributions:</b> <i>Ability to carry out individual responsibilities.</i>	Designated jobs are accomplished by deadline; completed work is carefully and meticulously prepared and meets all requirements.	Designated jobs are accomplished by deadline; completed work meets requirements.	Designated jobs are accomplished by deadline; completed work meets most requirements.	Some designated jobs are accomplished by deadline; completed work meets some requirements.
	<b>Individual Preparation and/or Contribution to Team Meetings:</b> <i>Ability to prepare and/or to contribute to team meetings.</i>	Thoroughly and carefully prepared for team meetings. Contributes by sharing information and knowledge.	Prepared for team meetings. Provides contributions.	Usually prepared for team meetings. Provides some contributions.	Routinely fails to prepare for team meetings. Provides little or no contributions.
	<b>Time Management:</b> <i>Ability to manage time (estimate, prioritize, establish</i>	Demonstrates the ability to manage time, including communicating and/or	Demonstrates the ability to manage time, including communicating	Demonstrates some ability to manage time.	Demonstrates minimal or no ability to manage time.

	<i>deadlines/ milestones, follow timeline, plan for contingencies, adapt to change).</i>	reacting and adapting to changes.	and/or reacting to changes.		
	<b>Credit and Accountability:</b> <i>Ability to share credit and accept accountability when working in a team.</i>	Shares credit and always accepts accountability.	Shares credit and accepts accountability.	Sometimes shares credit and accepts accountability.	Has difficulty or does not share credit or accept accountability.
Team Skills	<b>Leadership Skills:</b> <i>Ability to lead a team. (i) Mentors and accepts mentoring from others. (ii) Demonstrates capacity for initiative while respecting others' roles. (iii) Facilitates others' involvement. (iv) Evaluates team effectiveness and plans for improvements.</i>	Exemplifies leadership skills.	Demonstrates leadership skills.	Demonstrates some leadership skills at times.	Demonstrates minimal or no leadership skills.
	<b>Working with Others:</b> <i>Ability to listen to, collaborate with, and champion the efforts of others.</i>	Skilfully listens to, collaborates with, and champions the efforts of others.	Listens to, collaborates with, and champions the efforts of others.	Sometimes listens to, collaborates with, and champions others' efforts.	Rarely listens to, collaborates with, or champions others' efforts.
	<b>Promoting Positive Team Atmosphere:</b> <i>Ability to foster a positive and productive team atmosphere and keep team members working together. (i) Is courteous and respectful with team members; (ii) Demonstrates a positive attitude using verbal</i>	Always upholds and promotes a constructive team atmosphere by exhibiting courtesy, respect and a positive attitude, and by offering motivation and assistance. Works tirelessly to try to keep people	Promotes a constructive team atmosphere by exhibiting courtesy, respect and a positive attitude, and by offering motivation and assistance. Tries to keep people working together.	Sometimes promotes a constructive team atmosphere by exhibiting courtesy, respect and a positive attitude, and offering motivation and assistance. At times tries to keep people working	Rarely supports a constructive team climate with regards to courtesy, respect, attitude, motivation and assistance. Does not try to keep people working together.

	<p>and non-verbal cues, and tone.</p> <p>(iii) Inspires team members; (iv) Helps and encourages team members.</p>	working well together.		together.	
	<p><b>Addresses Conflict:</b></p> <p>Ability to identify, respond to and resolve potentially damaging conflict among team members.</p>	Identifies and responds to negative conflict in a prompt and helpful manner. Fortifies team relations and productivity through skilful conflict mediation.	Identifies and responds to negative conflict, and is able to mediate it.	Sometimes identifies conflict and tries to manage it.	Rarely identifies and/or addresses conflict.
	<p><b>Management of Multidisciplinary Teams:</b></p> <p>Ability to appreciate, understand and work with multidisciplinary team members.</p>	Has great appreciation for and understanding of disciplines outside of own. Works profitably with multidisciplinary team members.	Has appreciation for and understanding of disciplines outside of own. Works effectively with multidisciplinary team members.	Has some appreciation for and understanding of disciplines outside of own, but works less effectively with multidisciplinary team members.	Has no appreciation for or understanding of disciplines outside of own. Is unable to work effectively with multidisciplinary team members.
<p><b>PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.</b></p>					
	<p><b>Purpose:</b></p> <p>Ability to identify the reason for the communication, chooses the best communication for the task, and use the purpose to guide the communication.</p>	Purpose is clear and effectively guides the communication. Choice of communication is optimal.	Purpose is evident, and mostly guides the communication. Choice of communication is effective.	Purpose is somewhat clear and somewhat guides the communication. Choice of communication is somewhat effective.	Purpose is unclear. Does not guide the communication. Choice of communication is ineffective.
	<p><b>Main Idea:</b></p> <p>Ability to communicate the main</p>	Main idea is clearly and precisely stated.	Main idea is understandable.	Main idea is somewhat understandable.	Main idea is difficult to understand.



Technical Communication Skills	<i>idea.</i>				
	<b>Supporting Materials:</b> <i>Ability to use information sources (texts, journals, research) and/or generate materials (examples, statistics, analogies) to support the purpose and main idea, and establish credibility.</i>	Demonstrates <b>skilful</b> use of superior, trustworthy, pertinent and compelling materials that support the purpose and main idea.	Demonstrates <b>consistent</b> use of trustworthy, appropriate and pertinent materials that support the purpose and main idea.	Demonstrates <b>an attempt to</b> use trustworthy, appropriate and pertinent materials that support and develop the purpose and main idea.	Demonstrates <b>minimal or no attempt</b> to use trustworthy, appropriate and pertinent materials to support the purpose and/or main idea.
	<b>Organization:</b> <i>Ability to structure ideas to move logically forward. E.g., For written communication both macro (introduction, paragraphs, sequence of content, conclusion) and micro organization (sentences, transitions) are considered.</i>	Materials are <b>seamlessly arranged in a logical sequence</b> and both macro and micro elements enhance the work and the reader's comprehension.	Material <b>moves logically forward</b> , and both macro and micro elements are clear, coherent, and easy to follow.	Material has <b>some logical order</b> and is somewhat coherent or easy to follow.	Material has <b>little logical order</b> , and is often <b>unclear, incoherent</b> and <b>difficult</b> to follow.
	<b>Clarity and Conciseness:</b> <i>Ability to use language that clearly and concisely conveys meaning and supports the purpose of the work.</i>	Uses language that conveys meaning with clarity and parsimony, and <b>enhances</b> the purpose of the work.	Uses language that clearly and concisely conveys meaning, and <b>supports</b> the purpose of the work.	Uses language that generally conveys meaning, is <b>somewhat concise</b> , and supports the purpose of the work.	Uses language that may be unclear and/or <b>in concise</b> , may sometimes <b>impede meaning</b> , and <b>minimally supports</b> the purpose of the work.
	<b>Mechanics:</b> <i>Ability to use language that is mechanically corrects (punctuation, spelling, grammar).</i>	Communication contains <b>very few or no errors</b> .	Communication contains <b>some errors</b> , but errors <b>do not detract</b> from meaning.	Communication <b>contains errors</b> . Errors <b>may be distracting</b> .	Communication contains <b>many errors</b> . Errors <b>impede</b> meaning.

	<p><b>Genre and Conventions:</b> Ability to understand and use conventions intrinsic to engineering genres (formal/informal reports, lab reports, final completion reports, proposals, presentations).</p>	Demonstrates thorough/sophisticated understanding of and skilful use of the conventions inherent within the engineering genre.	Demonstrates understanding of and use of the conventions inherent within the engineering genre.	Demonstrates some understanding of and attempts to use the conventions inherent within the engineering genre.	Demonstrates minimal or no understanding of or effort to use the conventions inherent within the engineering genre.
Visuals for Written Communication	<p><b>Illustrations (Graphs, Tables, Figures and Diagrams):</b> Ability to use illustrations properly to support ideas (citations, position on page, integration, design and support of ideas).</p>	Illustrations are skilfully used to support ideas (correctly cited, skilfully positioned on page, well integrated and designed; they enhance points, explain, interpret, and assess information).	Illustrations are properly used to support ideas (correctly cited, positioned on page, integrated and designed; they support, explain and interpret information).	Illustrations are for the most part properly used to support ideas (an attempt is made to correctly cite, position on page, integrate, and/or design, and to support, explain or interpret information).	Illustrations are used, but minimally support ideas, and are not properly cited, positioned on page, integrated and/or designed. They do not support, explain or interpret information.
	<p><b>Formatting/Layout/Design of Communication:</b> Ability to use appropriate or prescribed format, which is effectively designed, clearly labelled, neatly and professionally presented.</p>	The appropriate/prescribed format is precisely followed. Design is exemplary. Headings are clear and add to the overall meaning of, and/or enhance the communication. Work is exceptionally neat and professionally presented. Format compels reading.	The appropriate/prescribed format is followed. Design is effective; headings are clear, and work is neatly and professionally presented. Format invites reading.	The appropriate/prescribed format is followed in most portions of the communication. Design is somewhat effective; headings are somewhat clear, and work is for the most part, neatly presented.	The appropriate/prescribed format is not followed. Design of communication is ineffective; headings are unclear, and work is not neatly presented. Format does not invite reading.

General Communication Skills	<b>Active Listening:</b> <i>Ability to pay attention to a speaker, summarize key ideas and supporting information.</i>	Demonstrates <b>skilful</b> ability to actively listen by rephrasing/repeating <b>all</b> of the speaker's key ideas and supporting information.	Demonstrates <b>ability</b> to actively listen by rephrasing/repeating <b>most</b> of the speaker's key ideas and supporting information.	Demonstrates <b>some</b> ability to actively listen by rephrasing/repeating <b>some</b> of the speaker's key ideas and supporting information.	Demonstrates <b>minimal</b> or <b>no ability</b> to actively listen to the speaker. Is <b>unable</b> to rephrase/repeat key ideas and/or supporting information. <b>May be distracting to others.</b>
	<b>Following Instructions:</b> <i>Ability to follow instructions (spoken and/or written).</i>	Is able to <b>concisely and effectively</b> follow spoken and/or written instructions.	Is able to <b>follow</b> spoken and/or written instructions.	Is <b>partially</b> able to follow spoken and/or written instructions.	Is <b>unable</b> to follow spoken and/or written instructions.
	<b>Giving/Writing Instructions:</b> <i>Ability to give/write clear directions or instructions, convey the sequence of steps and use clear examples/ references.</i>	Gives/writes <b>clear</b> and <b>concise directions</b> or instructions. Skilfully conveys the sequence of steps and uses model examples/references. Listener/reader easily and <b>smoothly</b> follows instructions.	Gives/writes <b>clear</b> directions or instructions. Conveys the sequence of steps and uses clear examples/references. Listener/reader can <b>follow</b> the instructions.	Gives/writes <b>somewhat clear</b> directions or instructions. Generally conveys the sequence of steps; uses some examples/references. Listener/reader can for the <b>most part</b> follow the instructions.	Gives/writes <b>unclear directions</b> or instructions. For the most part <b>does not convey</b> the sequence of steps. Uses <b>few or no</b> examples/references. Listener/reader has difficulty following the instructions.
	<b>Asking Questions:</b> <i>Ability to recognize and/or construct meaningful and relevant questions.</i>	Demonstrates a <b>skilful ability</b> to recognize and construct meaningful and relevant questions.	Demonstrates <b>an ability</b> to recognize and construct meaningful and/or relevant questions.	Demonstrates <b>some ability</b> to recognize and/or construct meaningful or relevant questions.	Demonstrates <b>minimal</b> or <b>no ability</b> to recognize or construct meaningful or relevant questions. May not be inclined to ask questions.

Communication Skills for Oral Reports	<b>Key Ideas: Organization and Articulation</b> <i>Ability to present strong key ideas and supporting details with clarity and concision (logical sequencing, clear transitions between points, introduction, supporting details and summary).</i>	Presentation logically and skilfully structured. Key ideas are compelling, and articulated with exceptional clarity and concision. Introduction, supporting details and summary are clearly evident and memorable, and ascertain the credibility of the speaker.	Presentation has clear structure and is easy to follow. Key ideas are clearly and concisely articulated, and are interesting. There is sufficient detail to ascertain speaker's authority, and presentation includes an introduction and summary.	Presentation has some structure. Key ideas generally identifiable, although not very remarkable. Introduction, supporting details and/or summary may be too broad, too detailed or missing. Credibility of the speaker may be questionable at times.	Presentation rambles. Not organized; key ideas are difficult to identify, and are unremarkable. No clear introduction, supporting details and summary. Speaker has no credibility.
	<b>Tailoring Communication:</b> <i>Ability to use language that is appropriate for:</i> (i) the target audience; (ii) The company/persons that the communicator is representing.	Communication is skilfully crafted to suit level of target audience and is appropriate for company/persons represented.	Communicator takes into consideration the target audience and company/persons represented. Communication contains details and/or technical content that are suitable for level of target audience.	Communicator takes some consideration of the target audience and company/persons represented. Communication may still contain some detail or technical content that are unsuitable for level of target audience.	Communicator takes minimal or no consideration of the target audience or company/persons represented. Communication may contain details or technical content that are unsuitable for level of target audience.
	<b>Time Management:</b> <i>Ability to complete presentation in the time allocated.</i>	Presentation fits perfectly within time constraint.	Presentation fits within time constraint, though presenter might have to subtly rush or slow down.	Presentation does not quite fit within time constraint; presenter has to rush or slow down at end.	Presentation is unsuitably short or unreasonably long.
	<b>Delivery (verbal):</b> <i>Ability to use diction, enunciation,</i>	Delivery makes the presentation compelling.	Delivery makes the presentation interesting.	Delivery makes the presentation	Delivery detracts from the presentation.

	<i>volume, pacing to effectively deliver the presentation.</i>			understandable.	
	<p><b>Delivery (non-verbal):</b></p> <p><b>Evidence of</b></p> <p><b>Preparation:</b> <i>Ability of presenter to:</i></p> <ul style="list-style-type: none"> <li>• Speak easily with few aids (note cards/slides) <ul style="list-style-type: none"> <li>• Control posture and gestures</li> </ul> </li> <li>• Position oneself in relation to audience, podium and slides</li> <li>• Control distractions (nervous habits, stall words)</li> </ul> <p><b>Audience Rapport:</b></p> <p>Ability of presenter to:</p> <ul style="list-style-type: none"> <li>• Sustain eye contact</li> <li>• Scan audience</li> </ul>	<p>Excellent delivery:</p> <ul style="list-style-type: none"> <li>• Sustained and comfortable eye contact</li> <li>• Can be clearly heard</li> <li>• Speaks confidently with few aids</li> <li>• Does not block screen</li> <li>• No distracting, nervous habits</li> <li>• Speaker is polished</li> </ul>	<p>Good delivery:</p> <ul style="list-style-type: none"> <li>• Makes eye contact</li> <li>• Can be heard easily</li> <li>• Speaks comfortably with some aids</li> <li>• Does not block screen</li> <li>• No distracting nervous habits</li> <li>• Speaker appears comfortable</li> </ul>	<p>Has minor difficulties with non-verbal delivery of presentation:</p> <ul style="list-style-type: none"> <li>• Effort to maintain eye contact</li> <li>• At times difficult to hear or understand</li> <li>• May overuse/underuse aids</li> <li>• At times hesitates, makes mistakes, or loses place; presentation seems memorized</li> <li>• At times blocks screen</li> <li>• Displays nervous habits (pauses, tapping, “um-ing” etc.)</li> <li>• Speaker appears tentative</li> </ul>	<p>Major difficulties with the non-verbal delivery of the presentation.</p> <ul style="list-style-type: none"> <li>• Sporadic or no eye contact</li> <li>• Hard to understand or hear</li> <li>• Uses aids excessively or not at all</li> <li>• Reads from paper</li> <li>• Stands in front of screen</li> <li>• Nervous habits are distracting (pauses, tapping, “um-ing” etc.)</li> <li>• Speaker appears uncomfortable.</li> </ul>
	<p><b>Visual Aids:</b></p> <p><i>Ability to design, use and integrate visual aids (slides, illustrations, props, demonstrations) that effectively support and focus the presentation.</i></p>	<p>Visual aids are skilfully/creatively designed, skilfully used and seamlessly integrated into the presentation. The presentation looks polished and professional.</p>	<p>Visual aids are well designed, used and integrated into the presentation. The presentation looks professional.</p>	<p>Visual aids are somewhat well designed, used and integrated into the presentation. The presentation looks somewhat professional.</p>	<p>Visual aids poorly designed (difficult to read; poor level of detail; missing captions or labels; misspelled words), and poorly used/overused. The presentation looks unprofessional.</p>

	<b>Appearance/Attire of Presenter:</b> <i>Ability to adopt an appearance/ attire that is appropriate to the presentation.</i>	Professional appearance / attire that is well suited for presentation.	Appearance/ attire is appropriate for presentation.	Appearance/ attire is not quite appropriate for the presentation.	Little or no consideration of appearance/ attire taken.
	<b>Q &amp; A with Audience:</b> <i>Ability to transition from presentation, listen to, answer and manage questions from the audience.</i>	Seamless transition from presentation to Q & A. Skilfully manages and responds to questions; gauges questioners' understanding; is able to clarify answers for diverse audiences and objectives.	Smooth transition from presentation to Q & A. Listens carefully and responds courteously, knowledgeably and clearly to questions.	Some ability to transition from presentation to Q & A. Understands most questions, responds somewhat knowledgeably and/or somewhat succinctly.	Minimal or abrupt transition from presentation. May not actively listen to questions, or provide knowledgeable answers, and/or may be unable to answer questions succinctly.

**PO 11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.**

<b>Project Management Economics</b>	<b>Proposal:</b> <i>Ability to understand the problem, the client's needs, and propose a plan.</i>	Demonstrates an ability to create a comprehensive proposal that skilfully addresses the problem and the client's needs.	Demonstrates an ability to create a proposal that addresses the problem and the client's needs.	Demonstrates some ability to create a proposal, which may not fully address the problem and/or the client's needs.	Demonstrates minimal or no ability to create a proposal.
	<b>Budget:</b> <i>Ability to create and/or adhere to a budget.</i>	Demonstrates a skilful ability to create and/or adhere to a budget. Budget covers all applicable areas, with room for contingencies.	Demonstrates an ability to create and/or adhere to a budget. Budget covers all applicable areas of project.	Demonstrates some ability to create and/or adhere to a budget. Budget covers most applicable areas.	Demonstrates minimal or no ability to create or adhere to a budget.
	<b>Risk Analysis:</b> <i>Ability to identify risks (physical, emotional, monetary, risks of</i>	Identifies all risks related to the project. Accurately estimates the likelihood of the	Identifies risks related to the project. Estimates the likelihood of the	Identifies some basic risks, and is able to estimate some of the likelihood of the risks,	Identifies few basic risks. May inaccurately estimate the likelihood of the risks,

	<i>repute, etc.) related to a project, consider the likelihood of the risks, and the gravity of their effects.</i>	risks, and the gravity of their effects.	risks, and the gravity of their effects.	and the gravity of their effects.	and/or the gravity of their effects.
	<b>Time and Change Management:</b> <i>Ability to estimate time on task, establish deadlines/ milestones, follow timeline, monitor and complete project. Ability to plan for contingencies and adapt to change.</i>	Demonstrates a <b>skilful ability</b> to manage time and change.	Demonstrates an <b>ability</b> to manage time and change.	Demonstrates <b>some</b> ability to manage time and change.	Demonstrates <b>minimal</b> or no ability to manage time and change.
	<b>Quality Assurance:</b> <i>Ability to understand and assure that work meets expectations/ specifications/ standards (project, client/ professor, industry, etc.).</i>	Demonstrates a <b>skilful</b> ability to understand quality assurance.	Demonstrates an <b>ability</b> to understand quality assurance.	Demonstrates <b>some</b> <b>ability</b> to understand quality assurance.	Demonstrates <b>minimal</b> or no ability to understand quality assurance.
	<b>Economics Principles:</b> <i>Ability to comprehend and employ economic principles of an engineering project, including short-term cost vs. long-term value.</i>	Demonstrates a <b>skilful ability</b> to comprehend and employ economic principles, including cost versus value.	Demonstrates an <b>ability</b> to comprehend and employ economic principles, including cost versus value.	Demonstrates <b>some</b> <b>ability</b> to comprehend and employ economic principles, including cost versus value.	Demonstrates <b>minimal</b> or no ability to comprehend and/or employ economic principles, including cost versus value.
	<b>Evaluation of Project Outcomes:</b> <i>Ability to evaluate the project and adapt for subsequent projects.</i>	Demonstrates a <b>skilful ability</b> to evaluate project outcomes and adapt for subsequent projects.	Demonstrates an <b>ability</b> to evaluate project outcomes and adapt for subsequent projects.	Demonstrates <b>some</b> <b>ability</b> to evaluate project outcomes and adapt for subsequent projects.	Demonstrates <b>minimal</b> or no ability to evaluate project outcomes or adapt for subsequent projects.

**PO 12: Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.**

<b>Life Long Learning</b>	<b>Interest and Curiosity:</b> <i>Inclination/ ability to explore a subject/topic in the pursuit of knowledge.</i>	Demonstrates a <b>skilful ability</b> to explore a subject/topic thoroughly, generating a variety of knowledge, possibly specialized or obscure, demonstrating deep fascination and curiosity.	Demonstrates an <b>ability</b> to explore a subject/topic, generating a variety of knowledge, demonstrating fascination and curiosity.	Demonstrates <b>some</b> ability to explore a subject/topic, providing some knowledge, demonstrating mild interest and growing curiosity.	Demonstrates <b>minimal</b> or no ability to explore a subject/topic, demonstrating minimal interest or curiosity.
	<b>Initiative:</b> <i>Inclination/ ability to explore additional opportunities for learning.</i>	Creates and seeks additional opportunities for learning.	Finds and pursues additional opportunities for learning.	Some inclination to <b>explore additional</b> opportunities for learning.	<b>Minimal or no</b> inclination to identify additional opportunities for learning.
	<b>Adaptability to New Situations:</b> <i>Ability to apply prior knowledge, skills and/or behaviours to new situations.</i>	Demonstrates a <b>skilful ability</b> to apply prior knowledge, skills and/or behaviours in an <b>innovative way to new situations</b> .	Demonstrates an <b>ability</b> to apply prior knowledge, skills and/or behaviours to <b>new situations</b> .	Demonstrates <b>some</b> ability to apply prior knowledge, skills and/or behaviours to new situations.	Demonstrates <b>minimal</b> or no ability to apply prior knowledge, skills and/or behaviours to new situations.
	<b>Staying Current:</b> <i>Engaged in staying current in the chosen field.</i>	Demonstrates an <b>active</b> and <b>thorough</b> engagement, and promotes staying current and <b>immersed</b> in the chosen field.	Demonstrates <b>engagement</b> in staying current in the chosen field.	Demonstrates <b>some</b> engagement in staying current in the chosen field.	Demonstrates <b>minimal</b> or no awareness or appreciation for staying current in the chosen field.
	<b>Asking Questions:</b> <i>Ability to recognize and/or construct meaningful and pertinent questions.</i>	Demonstrates a <b>skilful ability</b> to recognize and construct meaningful and pertinent questions.	Demonstrates an <b>ability</b> to recognize and construct meaningful and/or pertinent questions.	Demonstrates <b>some</b> ability to recognize and/or construct meaningful or pertinent questions.	Demonstrates <b>minimal</b> or no ability to recognize or construct meaningful or pertinent questions. May not be inclined to ask



					questions.
	<b>Handling Constructive Criticism:</b> Ability to accept and use constructive feedback (desists from quarrelling; considers others' points of view; shows appreciation for feedback; implements change).	Demonstrates a skilful ability to seek, accept and use constructive feedback.	Demonstrates an ability to accept and use constructive feedback.	Demonstrates some ability to accept and/or use constructive feedback.	Demonstrates minimal or no ability to accept and use constructive feedback.
	<b>Reflection (Lessons Learned):</b> Ability to reflect on (analyze and evaluate) experiences/ situations, and apply results from reflections to subsequent experiences/ situations. (Learns from successes and mistakes, and recognizes limitations.)	Reflect with depth and insight on experiences/situations. Skilfully applies what is learned from reflections to subsequent experiences/situations.	Demonstrates an ability to reflect on experiences/situations. Demonstrates learning through reflection.	Demonstrates some ability to reflect on experiences/situations. Demonstrates some learning through reflection.	Demonstrates minimal or no ability to reflect on experiences/situations. Tends to repeat mistakes.
	<b>Formulate a Topic /Define Research Scope:</b> Ability to frame a topic, determine research scope, identify essential concepts and define research questions.	Demonstrates the ability to succinctly articulate a topic. Clearly and concisely determines the research scope, identifies essential concepts and outlines research questions.	Demonstrates the ability to articulate a topic. Determines the research scope, identifies key concepts and drafts research questions.	Demonstrates some ability to articulate a topic, but the research scope is either too expansive or too limited. Can identify some key concepts and draft some research questions. Work needs refining.	Demonstrates minimal or no ability to articulate a topic. Difficulty determining the research scope, identifying key concepts and/or drafting research questions.
	<b>Execute a Search Strategy and Retrieve Needed Information:</b> Ability to use search strategies and access	Demonstrates the ability to use efficient and effectively-designed search strategies to retrieve the most relevant	Demonstrates the ability to use an assortment of search strategies to retrieve relevant and	Demonstrates the ability to use search strategies to retrieve some information sources, but strategies are	Demonstrates minimal or no ability to formulate simple searches effectively. Performs very basic

Research/ Information Literacy	<i>information.</i>	and appropriate information sources. Effectively and recurrently refines search.	appropriate information sources. Refines search as needed.	mainly simplistic and limited, and search scope too broad for task at hand. (Does not use controlled vocabularies.) Information is found within a narrow range of sources.	keyword searches (single words and/or simple phrases), which retrieve unacceptably large numbers of hits. Information is selected randomly, with little or no applicability or value.
	<b>Select and Evaluate Information and Sources</b> <b>Critically:</b> <i>Ability to use criteria to select and evaluate sources and information.</i>	Selects a variety of sources which thoroughly covers the range of research and directly relates to concepts or answers research questions. Able to skilfully analyze information sources based on reliability, validity, accuracy, authority, purpose, currency, relevance, partiality and audience. Sources are balanced and mostly authoritative.	Selects variety of sources which covers the range of research and relates to concepts or answers research questions. Demonstrates ability to distinguish between relevant and irrelevant information. Usually selects sources using multiple criteria, such as reliability, validity, accuracy, authority, purpose, currency, and relevance. Sources not always balanced.	Selects some relevant sources, but includes irrelevant sources. Chosen information is somewhat connected to research concepts or questions. Rarely evaluates information for reliability, validity, accuracy, authority, purpose, currency or relevance. Many sources are not authoritative, neither is there a variety or balance of sources.	Selects few sources with little breadth, i.e., many sources are from the same journal or web site, or from non-referred articles and/or very general web sites. Chosen information is not connected to research concepts or questions. Selects sources using limited criteria, such as reliability, validity, accuracy, authority, purpose, currency or relevance.

Research/ Information Literacy	<p><b>Use Information to Realize an Objective:</b></p> <p><i>Ability to use information from a variety of sources to achieve an intended purpose.</i></p>	<p>Condenses, organizes and integrates information from a variety of sources to effectively and fully, realize a specific purpose. Relates the relevancy of each source to the topic.</p>	<p>Condenses, organizes and integrates information from most sources to support purpose. Relates the relevancy of most sources to the topic.</p>	<p>Able to summarize several sources, but has difficulty integrating/making the connections necessary to support the purpose, (i.e., the information needs to be synthesized).</p>	<p>Has difficulty condensing and integrating information from many sources, so does not accomplish the proposed purpose. The information is disjointed and/or used incorrectly/ineffectively, i.e., misrepresented. Direct quotes from sources may be overused.</p>
	<p><b>Legal and Ethical Use of Information:</b></p> <p><i>Ability to appropriately employ strategies to demonstrate an ability to recognize, understand and apply proper ethical and legal use of intellectual property, copyrighted materials and research (i.e., proper use of references and citations, and restating, quoting and summarizing; allegiance to original context; differentiation between public and original knowledge).</i></p>	<p>Properly and legally cites all information sources. Gets permission to use information sources. Demonstrate complete comprehension of the legal and ethical boundaries when using intellectual property, copyrighted materials and research.</p>	<p>Properly and legally cites most information sources. For appropriate cases gets permission to use information sources. Demonstrates comprehension of the legal and ethical boundaries when using intellectual property, copyrighted materials and research.</p>	<p>Some evidence of properly and legally citing information sources. Does not always get permission to use information sources. Demonstrates some comprehension of the legal and ethical boundaries when using intellectual property, copyrighted materials and research.</p>	<p>Has quoted directly from sources without properly and legally citing information sources (plagiarism); or does not know about getting permission to use information sources. Does not understand the legal and ethical boundaries when using intellectual property, copyrighted materials and research.</p>