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UNIVERSITY OF PETROLEUM & ENERGY STUDIES
(P.O. Bidholi, via Premnagar, Dehradun Pin: 248 006)

End-semester Examination-December, 2017	**Max. Marks: 100**
Name of the Program: B. Tech (*Mining Engineering*)	**Semester – VII**
Course Title: Mine Automation and Rover-based Operations	**Code: MIEG 401**
This question paper has 2 (*two*) pages	**Duration: 3 hours**

Note: Include appropriate Question Number. Do not split answers on largely separated answer sheets. Overwriting, striking-off answers, illegible answer or any kinds of incorrect scribbling will not attract evaluation. Use pencil while drawing figures and other forms of charts.

SECTION: A

Questions from 1 to 10 carry 4 (*four*) marks each. Answer all of them? (10 × 04 = 40)

1. What is Design as a Discipline? How is this different from Design as Phase?
2. How Evolutionary systems development is different from Active User involvement?
3. Comment on User experience?
4. Critique on Proximity Detection Sensors?
5. Identify common patterns for haul truck accidents (driving)?
6. Show tunnel elements?
7. Identify Functional Block Diagram of the Robot – Human Control Architecture?
8. Identify differences between acquisition cycle and perception cycle?
9. Suggest measures to evaluate life-span of mining waste sites?
10. Show design of Cartesian-coordinated robot?

SECTION: B

Questions from 11 to 15 carry 8 (*eight*) marks each. Answer all of them? (05 × 08 = 40)

11. Support your arguments on the need for robotic systems in open cast mines?
12. Illustrate main parameters influencing road-header performance?
13. Compare Mining Remote Solutions?

14. Statement: 6-Degrees of Freedom in Robots would help in attaining maximum flexibility. Justify?

15. Explain Dumper Collision Avoidance System?

SECTION: C

Questions 16, 17 and 18 carry 5 (*five) + 5 (five*) + 10 (*ten*) marks each. Answer all of them?
(05 + 05 + 10 = 20)

Edited content of the following text has been taken from *https://hbr.org/2014/11/strategic-choices-in-building-the-smart-connected-mine* for academic purpose, only

Smart, Connected Products at Joy

Since the late 1990s, Joy Global has focused on building progressively smarter and more connected products designed to help optimize the performance of an entire mining operation (measured in cost-per-ton of ore produced per day).

Joy released its first “smart” machine in 1998, a self-propelled continuous miner. Its capabilities included the ability to control the machine from a safe location. For example, replacing the traditional manual hydraulic lever control with software and hardware enabled users to change performance settings and operate the product from a distance. In addition, sensors monitored the performance and operation of the machine and displayed the information on a local display panel. A digital user interface allowed both the operator and service technicians to quickly diagnose issues and failures.

Connectivity was added to Joy’s products in phases, starting in 1998 with the ability of a service technician to plug into machines and download sensor and fault data. By 2001, Joy had added the ability to connect equipment throughout the mine to computers located on the surface, using armored data cables (wireless connectivity is unreliable in a mining setting). Remote connectivity enabled new service efficiencies through continuous monitoring of machine performance and faults. For example, technicians needed to be dispatched underground only to address specific issues. Over time, Joy added more embedded sensors and expanded monitoring capabilities, onboard data storage, and diagnostics.

In 2008, Joy established a proprietary wireless system to connect information from each mine’s control center across multiple mines in South Africa. The South African Smart Service Center was the first of six Smart Service Centers in different regions that gather and analyze an increasing array of information from across Joy’s product system. Today, the company differentiates itself through what it calls “Smart Services”: the optimization of mine performance by prioritizing maintenance, increasing utilization, and reducing downtime for the equipment most critical to a mine’s operation.

16. Statement: …..replacing the traditional manual hydraulic lever control with software and hardware enabled users…
    Identify consequences of such replacement on mining sector? (5)

17. What could be outcomes from ‘Smart Services’ if implemented in India? (5)

18. What could be advantages of remote-connectivity in any of the mine sites you have visited? (10)