



colegsirgâr



Module Title: AUTOMATED TECHNOLOGY

Module Code: SGDM5008

Level: 5

Module Leader: Rob Rees

Award: BSc Mechanical Engineering

Lecturer: Rob Rees

Examination Solutions 2019-20

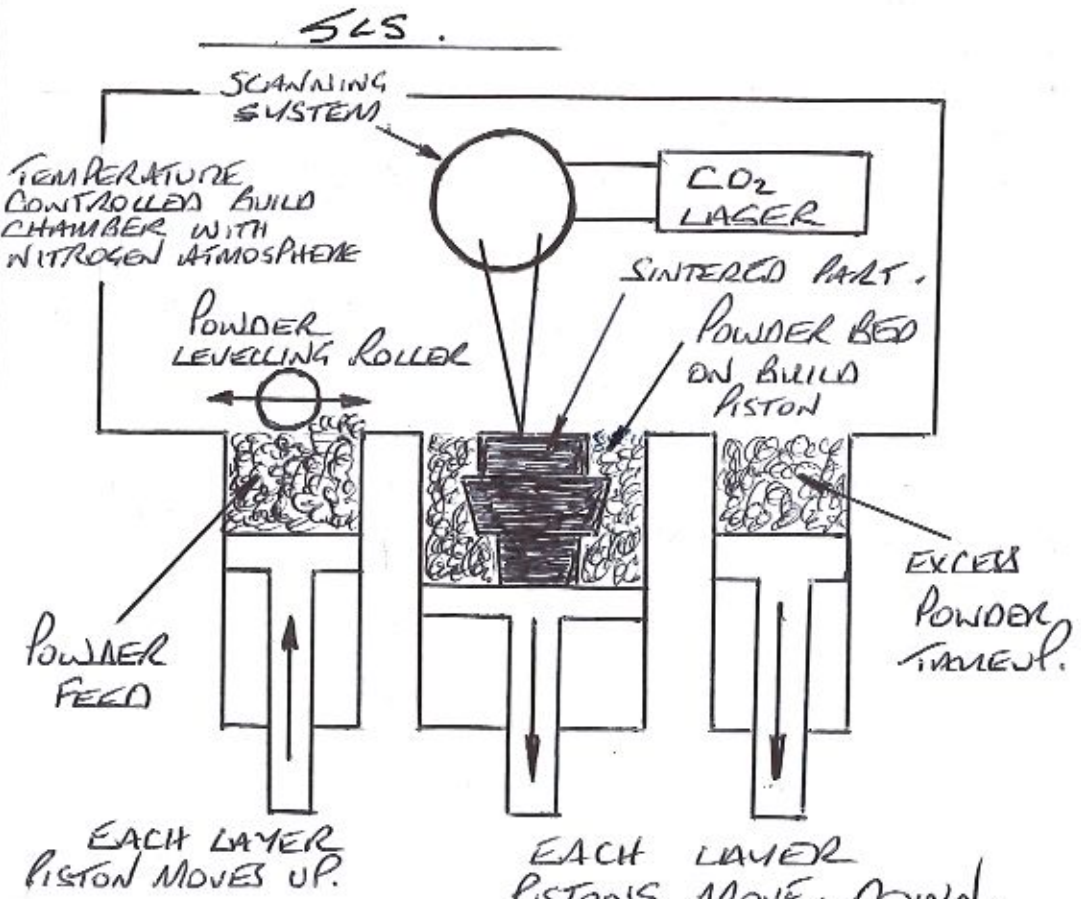
EXAMINATION SOLUTIONS

(To accompany the examination paper sent to the external examiner
but NOT to be seen by students)

Programme:	BSc Mechanical Engineering	Level:	5
Module:	Automated Technology SGDM5008		
Author:	Rob Rees	Date:	17/09/2019

Q No	Question	Marks
1a)	<u>DISCUSSIONS</u> BASED ON THE FIVE STEPS OF ADDITIVE MANUFACTURE. 1. CREATE SOLID MODEL (CAD/CAM) 2. CONVERT TO STL FILE 3. SLICE THE FILE 4. BUILD MODEL 5. CLEAN & FINISH.	5
1b)	DETAILED DISCUSSION ON THE THREE CATEGORIES OF RP. • LIQUID BASED • SOLID BASED • POWDER BASED. EXAMPLES OF LIQUID BASED (ONE FROM). • SLA • SLC EXAMPLES OF SOLID BASED (ONE FROM). • 3D PRINTING • FDM. • LOM EXAMPLES OF POWDER BASED (ONE FROM) • SLS. • SLM	6

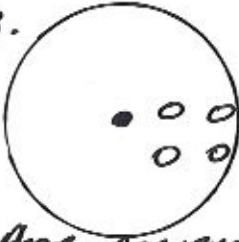
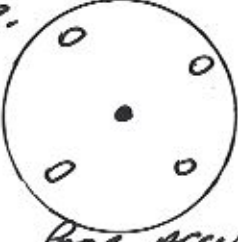


	Question	Marks
1c)	SUPPORT STRUCTURE - SACRIFICIAL MATERIAL THAT IS WATER SOLUBLE ES. POLY VINYL ALCOHOL (PVA). TOP DOWN STEREO LITHOGRAPHY & SOLID GROUND CURING USE THE SUPPORT BATH OF THE LIQUID RESIN BUILD MATERIAL. SLS (SELECTIVE LASER SINTERING) & SLM (SELECTIVE LASER MELTING) ADDITIVE MANUFACTURING PROCESSES USE THE POWDER BUILD MATERIAL AS SUPPORT MECHANISMS FOR THE FINAL PART. THE LOOSE POWDER IS REMOVED AWAY TO REVEAL THE FINAL PRODUCT.	4.
1d)	METAL PARTS CAN BE PRODUCED BY SLS (SELECTIVE LASER SINTERING) SLM (SELECTIVE LASER MELTING). <u>SLS.</u>  SCANNING SYSTEM CO₂ LASER TEMPERATURE CONTROLLED BUILD CHAMBER WITH NITROGEN ATMOSPHERE POWDER LEVELLING ROLLER SINTERED PART. POWDER BED ON BUILD PISTON EXCESS POWDER REMOVED. POWDER FEED EACH LAYER PISTON MOVES UP. EACH LAYER PISTONS MOVE DOWN.	



	Question	Marks
1d) CONT.	SIMILAR SCHEMATIC FOR SLM (ONLY ONE PROCESS LEAD)	5.
2a)	COBOT - COOPERATIVE & DESIGNED TO WORK WITH HUMANS. SENSORS PREVENT HARM TO HUMANS & SO CAN BE STOPPED DURING A PROCESS. MUCH LOWER ACCELERATION THAN ROBOTS (TYPICALLY 250mm/sec) SHORT LIFESPAN LOW PAYLOAD GRIPPER & FIXTURE EXCHANGE NOT POSSIBLE WITH COBOT. CAN WORK IN HARMONY WITH HUMANS (USING THE STRENGTHS OF BOTH TO CREATE A MORE EFFICIENT WORKSPACE). ROBOT. - DESIGNED TO WORK IN AN ISOLATED AREA - NO HUMAN INTERVENTION. PREDICTABLE WORK FLOW. VERY FAST ACCELERATION (TYPICALLY 1000mm/sec) CAN HANDLE HEAVY PAYLOADS CAN CHANGE EOAT & FIXTURE EXCHANGE. CAN WORK WITH A RANGE OF OTHER PROCESSES E.G. WELDING, PAINTSPRAYING, ADDITIVE MANUFACTURING, MACHINING ETC TAKES THE HUMAN OPERATOR OUT OF HAZARDOUS ENVIRONMENTS. MORE ACCURATE THAN A COBOT DUE TO THE RIGIDITY & MOTOR/JOINT DESIGN.	6



	Question	Marks
2b)	INDUSTRIAL ROBOTICS NEGATES THE COST OF MANPOWER AND ENABLES WESTERN COUNTRIES TO COMPETE WITH EMERGING MARKETS THAT HAVE A MUCH LOWER COST OF LIVING. ALSO - TAKES AWAY HUMANOUS ENVIRONMENTS. INCREASES PRODUCTION INCREASES REPEATABILITY (QUALITY) REDUCES WASTE. MAKES MAXIMUM USE OF SHOP FLOOR SPACE IF FLOOR MOUNTED / WALL MOUNTED / CEILING MOUNTED ROBOTS WORKING IN A SYNCHRONISED WORK PATTERN. DETAILED DISCUSSION ON ANY OF ABOVE.	6
2c)	<u>REPEATABILITY</u> IS A MEASURE OF A ROBOTS ABILITY TO GO TO A POINT OR ALONG A PATH, EXACTLY, TIME & TIME AGAIN UNDER THE SAME CONDITIONS. THIS POINT OR PATH MAY NOT BE IDENTICAL TO THE ONE PROGRAMMED. <u>ACCURACY</u> IS THE MEASURE OF THE DIFFERENCE BETWEEN THE TRUE PATH OR POINT, (THE ONE PROGRAMMED) AND THE ACTUAL POINT OR PATH TAKEN. CONSIDER A ROBOT THAT HAS TO PLACE 4 PARTS ABOUT THE CENTRE OF A CIRCLE. A.  HIGH REPEATABILITY HIGH ACCURACY B.  POOR ACCURACY HIGH REPEATABILITY C.  POOR ACCURACY POOR REPEATABILITY.	4.

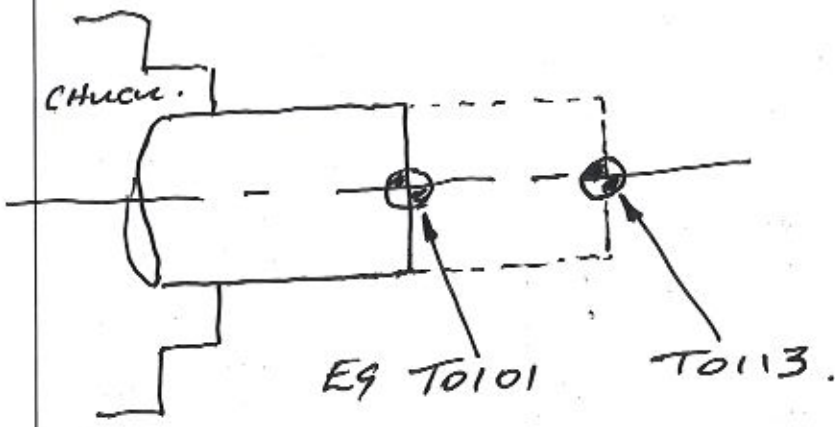


	Question	Marks
2d)	DISCUSSION OF INDUSTRIAL ROBOTICS BEING USED TO INCREASE THE WORKING ENVELOPE OF RP PROCESSES IN MANY MANUFACTURING SCENARIOS. EX. LARGE CASTING MOWLOS LARGE SCALE SLS, SUM COMPONENTS. A FUTURE DEVELOPMENT THAT IS BEING TESTED ON EARTH IS THE USE OF INDUSTRIAL ROBOTICS TO CREATE LIVING QUARTERS ON THE MOON USING THE MOON'S SILICATE MINERALS AS THE BUILD MATERIAL FOR SLS INTO CERAMIC TYPE STRUCTURES. THE ADVANTAGE IS THAT ESSENTIALLY ALL OF THE RAW MATERIALS FOR CONSTRUCTION ARE ALREADY ON SITE.	4.
3a)	DETAILED DISCUSSION ON THE 4 PHASES OF THE INDUSTRIAL REVOLUTION WITH KEY DATES AND THE INCREMENTAL TECHNOLOGICAL STEPS THAT ENABLED THE PHASE CHANGES.	4
3b)	THE FOUR V'S OF BIG DATA. VOLUME, VARIETY, VELOCITY, VERACITY. DETAILED DISCUSSION OF THE MEANINGS OF EACH OF THE ABOVE AND THE EFFECT THAT BIG DATA HAS ON INDUSTRY 4.0.	4.



	Question	Marks
3c)	IOT ARE PLUG & PLAY 'INTERNET OF THINGS' DEVICES AND NOT SECURE IIOT ARE 'INDUSTRIAL INTERNET OF THINGS' AND MORE RESISTANT TO EXTREME CONDITIONS. BOTH TECHNOLOGIES TRANSFER DATA TO A NETWORK WITHOUT HUMAN INTERVENTION USING IPV6 PROTOCOL (128 BITS). DETAILED DISCUSSION ON ABOVE.	4.
3d)	SELECTION AND EXPLANATION OF ONE OF THE CASE STUDIES DISCUSSED IN THE MODULE. EG REAL TIME LOCATION SYSTEMS (RTLS) BOSCH TRACK & TRACE, AGV'S ETC.	4.
3e)	ADVANTAGES OF INDUSTRY 4.0. • EFFICIENT MANUFACTURING • ENVIRONMENTAL SUSTAINABILITY • CUSTOMISATION / BESPOKE PRODUCTS • PHYSICAL WORK REDUCTION. DISADVANTAGES OF INDUSTRY 4.0. • SECURITY OF INFORMATION / DATA. • HIGHLY DEPENDANT ON TECHNOLOGY • WHOLE PRODUCTION PROCESS MAY BE HALTED IF ONE SYSTEM FAILS.	2 FROM 2 FROM 4



	Question	Marks
4a).	TOOL MEASURING DISCUSSION ON TOUCH PROBE TOOL SETTING AND CUT & MEASURE. X AXIS — CUT IS TAKEN ON DIAMETER OF BAR & DIAMETER ENTERED INTO THE CONTROL FOR THE TOOL N^o. Z- AXIS — A LENGTH BAR IS PLACED UP AGAINST THE CHUCK BODY AND TOOL DRIVEN UP AND ACCURATELY POSITIONED USING FEEDER GAUGES. TOOL LENGTH IS RECORDED AND ENTERED INTO THE CONTROL. BASIC SKETCHES OF ABOVE RECD TOOL OFFSETS. EACH TOOL N^o HAS TWO OFFSETS Eg TO1 01 TO1 13 TO2 02 TO2 14 EACH OFFSET ALLOWS FOR THE ZERO DATUM SHIFT TO THE FRONT FACE OF A PARTICULAR COMPONENT. 	6



Question

Marks

4b) G71 — AREA CLEARANCE (ROUGHING CYCLE).

U = DEPTH OF CUT.

R = TOOL LIFT OFF.

P = GEOMETRY START BLOCK

Q = GEOMETRY END BLOCK

U = STOCK ALLOWANCE FINISHING CUT
X AXIS

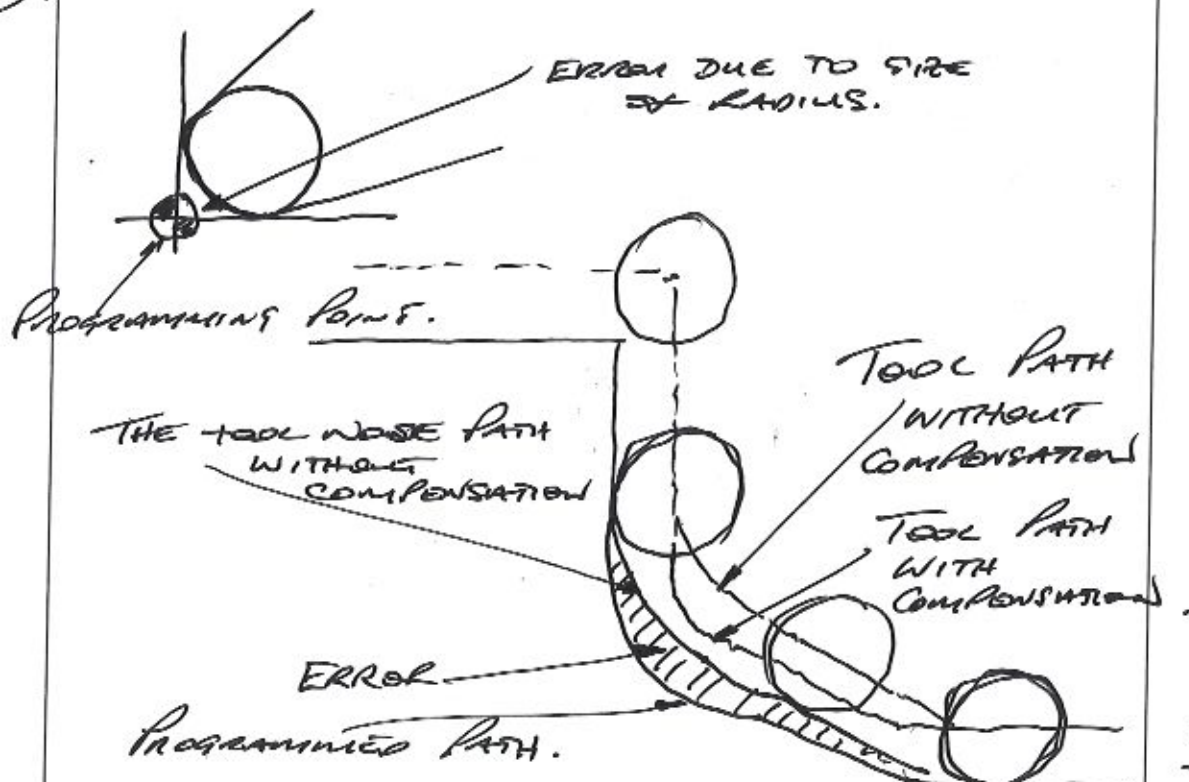
W = STOCK ALLOWANCE FINISHING CUT
Z AXIS.

F = ROUGHING FEED RATE.

NOTE — FINISHING CUT FEED RATE IS
DETERMINED BY THE PROGRAMMED
FEED FOR THE FINISHING TOOL IN THE
MAIN BODY OF THE PROGRAM.

5.

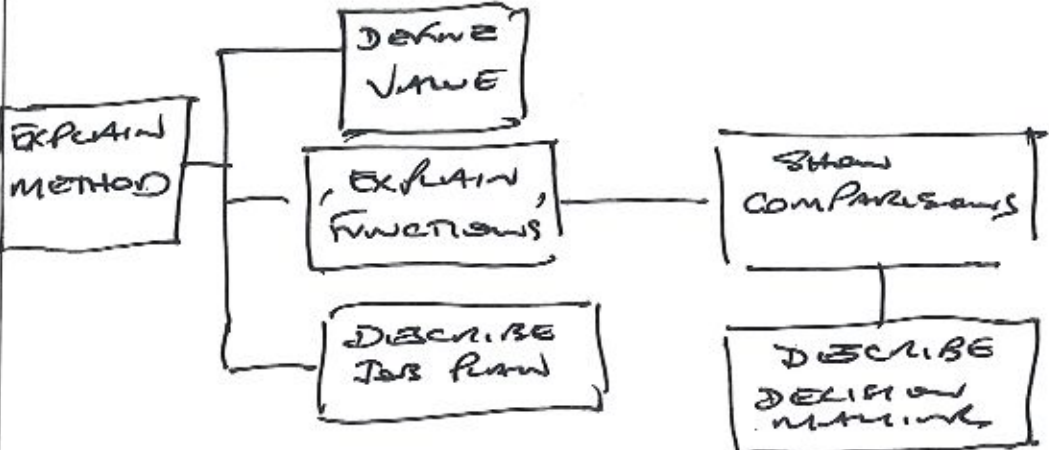
4c) TOOL NOSE RADIUS COMPENSATION



5.



	Question	Marks
4d)	EXPLANATION OF C AXIS MACHINING LIVE TOOLING AND ACCURATE CONTROL OF SPINDLE (C AXIS) TWO EXAMPLES FROM • PRECISION RADIAL DRILLING • MACHINING FLATS • ENGRAVING (RADIAL & FACE) • RADIAL SLOTTING • THREAD MILLING	4.
5a)	VALUE ENGINEERING IS AN ORGANISED STUDY OF FUNCTIONS TO SATISFY THE USER'S NEEDS WITH A QUALITY PRODUCT AT THE LOWEST LIFE CYCLE COST THROUGH APPLIED CREATIVITY. INDUSTRY 4.0 TECHNOLOGY PROVIDES ESSENTIAL DATA THAT IMPROVES DECISION MAKING AND FORECASTING. REAL TIME ANALYSIS ALSO REDUCES MACHINE DOWNTIME AND BREAKDOWNS THEREBY INCREASING YIELD AND REDUCING OVERALL PRODUCTION COSTS.	
5b)	FAST DIAGRAMS F - FUNCTION A - ANALYSIS S - SYSTEM T - TECHNIQUE. FAST DIAGRAMS REPRESENT THE FUNCTIONS OF A PROJECT, PRODUCT OR PROCESS BASED ON THE QUESTIONS HOW OR WHY?	

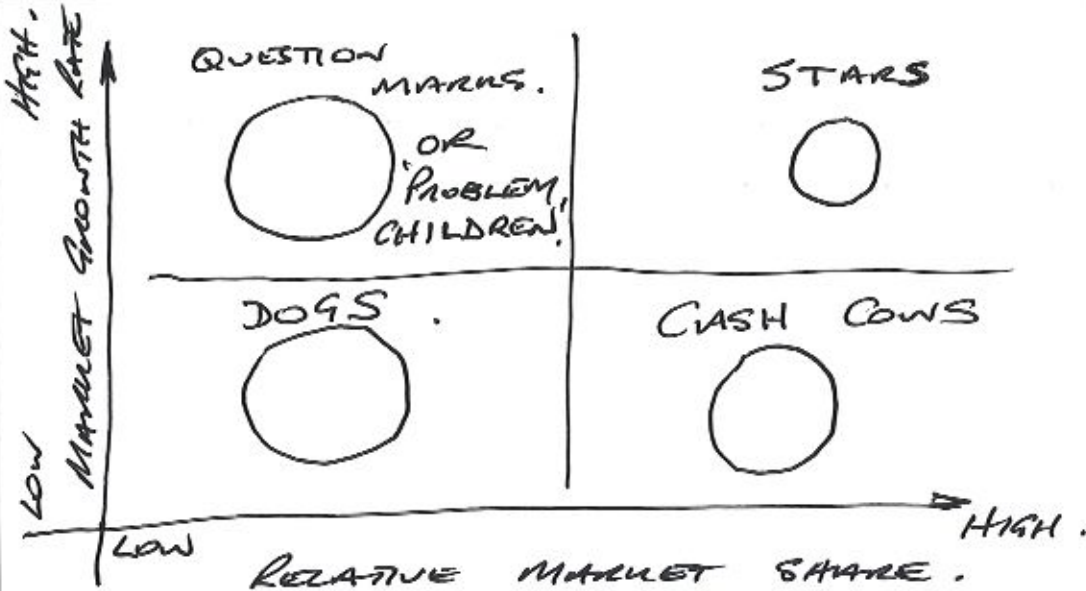
	Question	Marks
5b) QWTF.	BASICS OF FAST DIAGRAM  HIGHER ORDER FUNCTION (HOF) BASIC FUNCTION SUPPORTING FUNCTION DISCUSS PRODUCTS THAT HAVE DRAMATICALLY REDUCED IN PRICE AS A RESULT OF VALUE ANALYSIS EG WIDE SCREEN TV'S ETC. PC'S. PRODUCE A FAST DIAGRAM OF A CASE STUDY THAT WAS COVERED IN THE MODULE AND DISCUSSION OF THE MAIN AREAS.	6.
5c).	THE BOSTON MATRIX IS A COMMON METHOD OF PORTFOLIO ANALYSIS DEVELOPED BY THE BOSTON CONSULTING GROUP (BCG) PRODUCT LIFE CYCLE ANALYSIS SHOWS SALES OF ONE PRODUCT OVER TIME. THE BOSTON MATRIX IS ABLE TO ANALYSE MORE THAN ONE OF A COMPANY'S PRODUCTS AND CATEGORISES THEM INTO....	



Question

Marks

5c)
CONT.

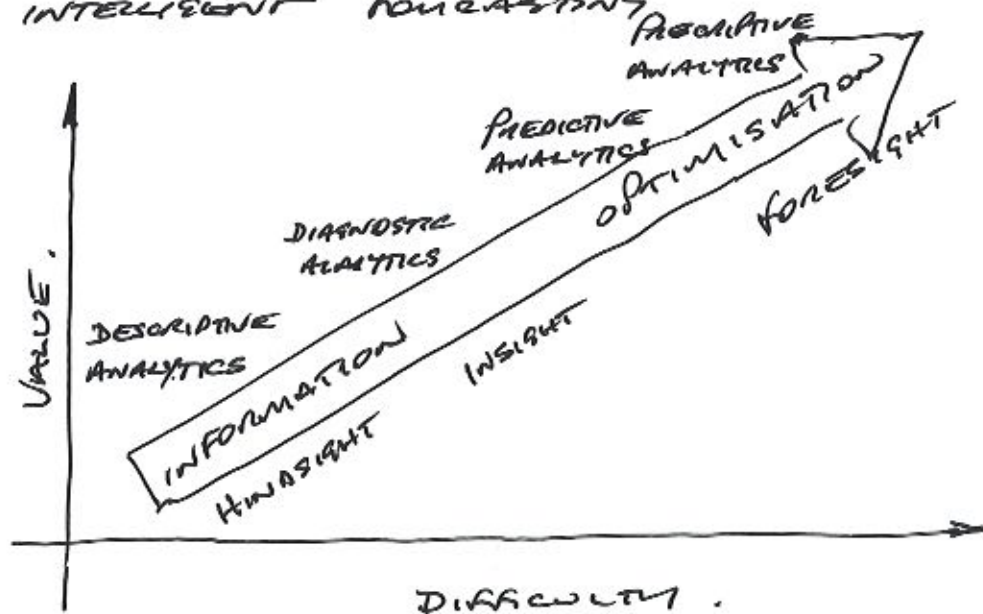


DISCUSSION BASED ON ABOVE BUT USING SPECIFIC CASE STUDY EXAMPLE TAUGHT DURING THE MODULE.

5

5d)

IIOT TECHNOLOGY IS HAVING A PROFOUND EFFECT ON PRODUCT LIFE CYCLE MANAGEMENT DUE TO A SIGNIFICANT LOSS IN DATA COLLECTION AND MANAGEMENT. ADVANCED ANALYTICS ENABLES FASTER REACTION TIME AND INTELLIGENT FORECASTING





Marks	Question
4.	Discussion of a case study of IoT influencing the product life cycle.