N09/4/DESTE/HP3/ENG/TZ0/XX/M

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MARKSCHEME

NOVEMBER 2009

DESIGN TECHNOLOGY

Higher Level

Paper 3

24 pages

General Marking Instructions

Assistant Examiners (AEs) will be contacted by their Team Leader (TL) by email or telephone – if by email, please reply to confirm that you have downloaded the markscheme from IBIS. The purpose of this contact is to discuss the standard of marking, the interpretation of the markscheme and any difficulties with particular questions. AEs should contact their team leader by email at any time if they have any problems/queries during the marking process.

You should contact the TL whose name appears on your "Allocation of Schools listing" sheet.

Note:
Please use a personal courier service when sending sample materials to TLs unless postal services can be guaranteed. Record the costs on your examiner claim form.

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1. Follow the markscheme provided, award only whole marks and mark only in **RED**.

2. Where a mark is awarded, a tick/check (✓) **must** be placed in the text at the **precise point** where it becomes clear that the candidate deserves the mark. **One tick to be shown for each mark awarded.**

3. Sometimes, careful consideration is required to decide whether or not to award a mark. In these cases write a brief annotation to explain your decision. You are encouraged to write comments where it helps clarity, especially for moderation and re-marking. It should be remembered that the script may be returned to the candidate.

4. Unexplained symbols or personal codes/notations are unacceptable.

5. Record marks in the right-hand margin against each mark allocation shown in square brackets *e.g.* ***[2]***. The total mark for a question must equal the number of ticks for the question.

6. Do **not** circle sub-totals. **Circle the total mark** for the question in the right-hand margin **at the end of the question.**

7. Where an answer to a part question is worth no marks, put a zero in the right-hand margin next to the square bracket.

8. Where work is submitted on additional sheets the marks awarded should be shown as ticks and a note made to show that these marks have been transferred to the appropriate square bracket in the body of the script.

9. For each Option: Add the totals for each question in the Option and write it in the Examiner column on the front cover.
Total: Add the marks awarded and enter this in the box marked TOTAL in the Examiner column on the cover sheet.

10. After entering the marks on the front cover check your addition to ensure that you have not made an error. Check also that you have transferred the marks correctly to the cover sheet. **All scripts are checked and a note of all clerical errors will be given in feedback to examiners.**

11. If an answer extends over more than one page and no marks have been awarded on a section draw a diagonal line through that section to indicate that it has been marked.

12. If a candidate has attempted more than the required number of questions within a paper or section of a paper, mark all the answers and use the marks of those answers that have the highest mark, **unless the candidate has indicated the question(s) to be marked on the front cover**.

13. A mark should not be awarded where there is contradiction within an answer. Make a comment to this effect in the left-hand margin.

Subject Details: Design Technology HL Paper 3 Markscheme

Mark Allocation

Candidates are required to answer questions from **ONE** of the Options **[1 × 40 marks]**.
Maximum total = **[40 marks]**

1. A markscheme often has more marking points than the total allows. This is intentional. Do **not** award more than the maximum marks allowed for part of a question.

2. Each marking point has a separate line and the end is signified by means of a semicolon (;).

3. An alternative answer or wording is indicated in the markscheme by a slash (/) – either wording can be accepted.

4. Words in brackets ( ) in the markscheme are not necessary to gain the mark.

5. Words that are underlined are essential for the mark.

6. The order of marking points does not have to be as in the markscheme, unless stated otherwise.

7. If the candidate's answer has the same "meaning" or can be clearly interpreted as being of equivalent significance, detail and validity as that in the markscheme then award the mark. Where this point is considered to be particularly relevant in a question it is emphasized by writing ***OWTTE*** (or words to that effect).

8. Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.

9. Occasionally, a part of a question may require an answer that is required for subsequent marking points. If an error is made in the first marking point then it should be penalized. However, if the incorrect answer is used correctly in subsequent marking points then **follow through** marks should be awarded. Indicate this with **ECF (**error carried forward).

10. Only consider units at the end of a calculation. Unless directed otherwise in the markscheme, unit errors should only be penalized once in the paper. Indicate this by writing **–1(U)** at the first point it occurs and **U** on the cover page.

11. Do not penalize candidates for errors in significant figures unless it is specifically referred to in the markscheme.

Option A — Food science and technology

A1. (a) *Award **[1]** for stating **one** advantage for the consumer of purchasing food from the farm.*
fresher food;
cheaper food / cuts out intermediaries/middlemen;
better traceability (the consumer knows where the food comes from);
support for local economy; ***[1 max]***

(b) *Award **[1]** for stating **one** stakeholder in the food chain involved in the secondary processing of food.*
farmer;
food manufacturer;
consumer; ***[2 max]***

(c) *Award **[1]** for each distinct point in an explanation of **one** advantage of on-farm processing of food for the farmer.*
increased profitability;
processed foods, especially craft produced foods, command higher prices than unprocessed foods;
farmers can capture a larger proportion of the food dollar / the money the consumer pays for food;

enhancement of sustainability of rural economy;
it creates jobs in rural communities;
this should result in fewer people shifting to urban areas to find work;

less waste;
food is not transported pre-processing;
transporting food pre-processing can result in damage to the food; ***[3 max]***

A2. (a) *Award **[1]** for a definition of genetically-modified organism to the effect of:*
a plant or animal in which the DNA has been altered through the insertion of genetic material from another source; ***[1]***

(b) *Award **[1]** for identifying **one** factor underpinning the genetic modification of foods and **[1]** for a brief explanation.*
enhanced yield/earlier yield;
fruit and nut trees that produce a crop years earlier than normal;

better performance in extreme conditions;
drought / extreme temperatures / high salinity can be tolerated better (good re: global warming/desertification);

enhanced nutritional qualities;
crops may have better nutritional profiles, *e.g.* rice with increased iron and vitamins that may alleviate chronic malnutrition in Asian countries;

improved resistance to attack by pathogens;
e.g. herbicide insect resistant soybeans / corn / cotton / canola / alfalfa;
sweet potato resistant to a virus that could decimate most of the African harvest;
cows that are resistant to bovine spongiform encephalopathy (mad cow disease);

reduced need for application of agricultural chemicals;
environmental benefits / reduced costs;

enhanced resistance to herbicides;
a field of the crop can be sprayed with a weed killer without damaging the crop;

enhanced eating quality/ripening/storage characteristics;
harvesting and distribution issues can be resolved, *e.g.* the FlavrSavr tomato; ***[2 max]***

A3. (a) *Award **[1]** for identifying **one** reason for preserving milk, apart from extending its shelf life.*
food safety;
raw milk contains large numbers of micro-organisms some of which could cause food poisoning;

availability;
raw milk spoils quickly and would go to waste;

acceptability;
spoiled milk is extremely unpleasant; ***[2 max]***

(b) *Award **[1]** for identifying **one** advantage of HPMT treatment for preserving milk over UHT treatment and **[1]** for a brief explanation.*
fresh milk flavour;
UHT milk has a cooked milk flavour which makes it unacceptable to many people; ***[2]***

A4. *Award **[1]** for each of **two** impacts on consumer health resulting from a change from traditional diets and **[1]** for each of **two** additional distinct correct points of explanation for each impact.*

increased incidence of "diseases of affluence" / high blood pressure/diabetes/stroke/ gallbladder disease/breast cancer/prostate cancer;
traditional diets have a lower nutrient density;
high nutrient density results in more overweight/obese persons;

problems associated with the gut, *e.g.* cancer of the colon;
traditional diets are high in fibre;
reduced fibre intake increases gut transit time and can result in constipation;
high fibre diets reduce gut transit time and reduce constipation;

increased rates of cancer and heart disease;
traditional diets rich in vitamins (C, E, folic acid), minerals (magnesium, potassium and calcium);
these nutrients act as antioxidants; ***[6 max]***

A5. (a) *Award **[1]** for each of **two** distinct points in a description of the term "high risk" foods.*
foods that support the growth of food poisoning bacteria;
e.g. milk, mayonnaise, meat, fish; ***[2]***

(b) *Award **[1]** for each of **two** distinct points in a description of the temperature danger zone for bacterial growth.*
above 10 °C;
below 63 °C;
warm; ***[2 max]***

(c) *Award **[1]** for listing each of **two** considerations that determine whether a chicken portion is thoroughly cooked.*
cooking temperature;
cooking time;
size of the food being cooked / small items cook quicker than large items;
initial temperature of the food / cooking frozen foods takes longer than cooking chilled foods; ***[2 max]***

A6. (a) *Award **[1]** for each of **three** distinct points of explanation of the significance of food security in the fight against poverty.*

food is a basic human need / food is at the bottom of Maslow's hierarchy of needs;
food security must be achieved before people can think of other development issues;
food insecurity results in under-nutrition which can lead to death / increased incidence of diseases associated with nutritional deficiency and other diseases associated with living in poor environments; ***[3]***

(b) *Award **[1]** for each of **three** distinct points of explanation of why it is important that the Millennium Villages project is community-led.*

ownership by local people;
not aid foisted upon them from outside;
developments will be consistent with local culture/values;
this will prevent the erosion of indigenous culture;
empowers the community;

team spirit;
community members work together to resolve issues;
enhanced sustainability in the long term; ***[3 max]***

A7. *Award **[1]** for each of **three** distinct points of explanation for how aeration, protein coagulation and gelatinization affect the physical and/or chemical properties of bread **[3 max]** per process.*

aeration:

tiny bubbles of carbon dioxide are formed in the dough by the action of yeast;
these expand the dough in the proving process;
they reduce the density of the bread and contribute to its final open texture;

protein coagulation:

flour mixed with water forms dough which contains an extended protein (gluten) network which is elastic and stretches as the dough is proved to contain the carbon dioxide;
cooking the bread coagulates the protein;
this means that the bread cannot return to its original shape and thus the aerated texture is retained;

gelatinization:

starch is gelatinized in the cooking of bread;
in gelatinization starch granules are broken open and water can penetrate the starch granule;
the starch granule is converted into a gel which changes its eating properties; ***[9 max]***

Option B — Electronic product design

B1. (a) *Award **[1]** for identifying the component labelled X in the logic circuit.*
thermistor; ***[1]***

(b) *Award **[1]** for identifying the colours of bands 2 and 3 on the 1 kΩ resistor shown in Figure B2.*
band 2: black;
band 3: red; ***[2]***

(c) *Award **[1]** for each distinct correct point in an explanation of why there is a maximum but no minimum dimension for "G".*
as the temperature rises the resistance of the thermistor will fall to less that 1 kΩ;
the input to the logic gate will then rise above 2.5V which is the threshold;
the reverse will happen as the temperature falls; ***[3 max]***

B2. (a) *Award **[1]** for a definition of dematerialisation to the effect of:*
the reduction of weight and use of materials in the design and manufacture of a product; ***[1]***

(b) *Award **[1]** for stating each of **two** ways in which manufacturers can minimise the damage caused to the environment during the life of an electronic product.*
use the minimum amount of toxic material;
use easily disassembled parts;
use upgradeable functionality;
use recyclable parts;
minimise energy usage during manufacture/use during manufacture/use; ***[2 max]***

B3. (a) *Award **[1]** for calculating the time it will take for the capacitor to discharge and **[1]** for the correct answer including units*
$t = 0.7\,CR = 0.7 \times 0.000100 \times 270000$;
18.9 seconds; ***[2]***

(b) *Award **[1]** for each of **two** distinct points in a description of the effect of connecting a second 200 μF capacitor in parallel with the first.*
total capacitance is now 300 μF;
therefore it will take three times as long to discharge/$18.9 \times 3 = 56.7$ seconds/ about a minute; ***[2]***

B4. *Award **[1]** for explaining **two** differences between frequency division multiplexing and time division multiplexing, and **[1]** for each of **two** additional distinct correct points of explanation for each aspect **[3 max]** per aspect.*

Aspect	FDM	TDM
multiple concurrent users;	yes;	yes;
use of link;	use link simultaneously;	use the link in turn;
data flow in two directions;	yes;	yes;
number of simultaneous users;	determined by data rate of each user;	determined by data rate of each user;
synchronization of receiver with transmitter required;	no;	yes;
decoding;	yes;	no;
buffering required;	no;	yes;

[6 max]

B5. (a) *Award **[1]** for identifying a way in which convergent technologies could expand human communication and **[1]** for a brief explanation.*
translation capability/enable people to communicate with each other more easily;
promote global cooperation/collaborative global projects without travelling; ***[2]***

(b) *Award **[1]** for identifying a way in which convergent technologies could be applied to national defence and **[1]** for a brief explanation.*
humans can operate remotely from combat zone;
unmanned combat vehicles/protect human life;

can collect and process data;
optimise attack/defence strategies;

secure communication to front-line troops;
interface combatants with remote weapon systems;

training;
virtual environments; ***[2 max]***

(c) *Award **[1]** for identifying a way in which convergent technologies could improve human health and **[1]** for a brief explanation.*
nano-scale implants for diagnostic/treatment purposes;
keyhole surgery/minimize tissue damage;

regenerative biosystems;
allow repair/replacement of organs;

compensation for physical/mental deficiencies;
making humans stronger/smarter/more durable/healthier; ***[2 max]***

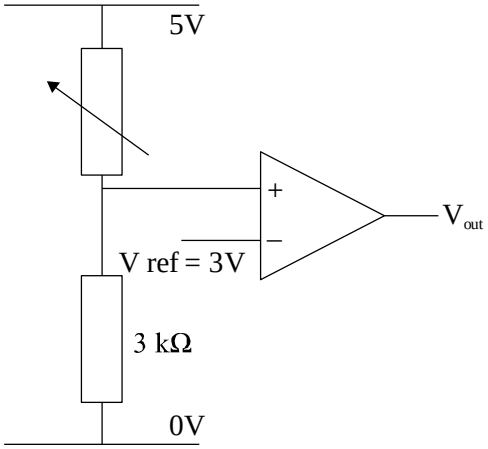
B6. (a) *Award **[1]** for each of **three** distinct points in an explanation of how a PIC could be integrated into a heating system for a smart home.*
input: monitor temperature;
process: compare temperature with required setting;
output: turn heating on and off; ***[3]***

(b) *Award **[1]** for each of **three** distinct points in an explanation of why PICs are particularly suitable for controlling a smart home.*
reprogrammability;
PICs can be easily programmed and reprogrammed using software;
functionality can be upgraded over time;

easily interfaced with a number of devices;
multiple inputs and outputs;
makes them versatile; ***[3 max]***

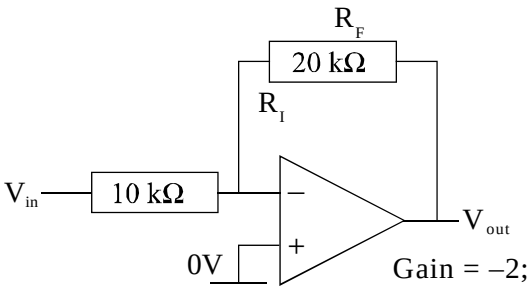
B7. *Award **[1]** for the correct circuits for each of **three** different ways in which an operational amplifier can be used, **[1]** for showing the component values for each circuit and **[1]** for showing the calculation for each circuit **[3 max]** per application mode, **[9 max]** for question.*

Comparator:

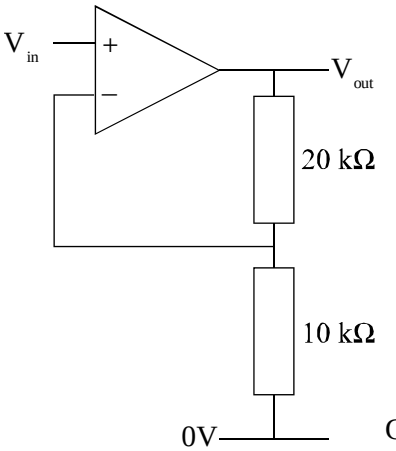


V out will fall from +13 V to –13 V when the variable resistor rises above 2kΩ;

Inverting Amplifier:



Non-inverting amplifier:



Gain = +3 ***[1 mark]***

$V_{out}=1+R_1/R_2$ ***[9 max]***

Option C — CAD / CAM

C1. (a) *Award **[1]** for the statement of a reason.*
training is not carried out on a real patient;
dentist will be better skilled;
less pain for the patient; ***[1 max]***

(b) *Award **[1]** for each point in a description of how haptic technology works.*
haptic technology works by using mechanical actuators;
to apply forces to the user;

the user is part of a computer simulation;
which senses movement and provides feedback; ***[2 max]***

(c) *Award **[1]** for each point in an explanation.*
it is only a simulation;
so it can only give an approximation to how a patient will react;
so cannot replace all physical tests;

haptic technology is still in its infancy;
so the size of instrumentation may limit movement;
so feedback will be limited;

this new technology is expensive;
due to limited market;
and early stages of research and development; ***[3 max]***

C2. (a) *Award **[1]** for stating one advantage*
immediate revision possible;
designer can be in one place and client in another;
provides a closer relationship between designer and client;
speed;
storage;
better feedback;
image of product without having to manufacture it;
enables 2D/3D graphical communication;
can produce very accurate 3D models; ***[1 max]***

(b) *Award **[1]** for each point in an outline of how the copyright of designs is an issue.*
electronic communication of designs;
which may allow unauthorized access;

product can be re-engineered;
with incremental changes;

many different storage systems;
increases risk of theft;

electronic storage of designs;
needs encryption/password protection / could be hacked into; ***[2 max]***

C3. (a) *Award **[1]** for each point in a description.*
an FDM machine is basically a CNC robot;
that extrudes material to make up the model;

the extrusion head moves back and forth along a platform;
building up the model in a series of layers; ***[2 max]***

(b) *Award **[1]** for each point in an outline of why FDM is not suitable for volume produced components.*
process is too slow;
due to time for the material to fuse / for the number of layers to be built up;

material cost is expensive;
so only suitable for low volume;

material choice is limited;
so properties may not be suitable for the product; ***[2 max]***

C4. *Award **[1]** for stating a benefit and **[1]** for each additional point of explanation **[3 max]** for each of **two** benefits.*
range of software packages;
which allow for different types of models of the phone (*e.g.* wire frame, solid, exploded views and zooming);
allow for product development without the need for CAM modelling;

CAD can be linked to CAM;
to produce physical models;
for performance tests (to aid development); ***[6 max]***

C5. (a) *Award **[1]** for each point in identifying a characteristic of using wax to make jewellery using a CNC.*
hardness;
can show intricate detail / good quality of cut surface; ***[2]***

(b) *Award **[1]** for each point in a suitable outline*
low melting temperature;
offcuts, unwanted moulds can be melted down and reshaped into blocks;

easy to cut;
so it's cost effective to use;

self lubricating material;
which reduces tool wear; ***[2 max]***

(c) *Award **[1]** for identifying a way in which jewellery has changed and **[1]** for a valid reason.*
CNC machinery can cope with wider range of materials;
promotes innovation/new product development;

complex shapes can be produced;
they do not need hand finishing;

high level of precision;
at relatively low price;

quality of surface finish;
without the need for hand finishing; ***[2 max]***

C6. (a) *Award **[1]** for an advantage and **[1]** for each of **two** distinct points in an explanation.*
consistency;
robots don't suffer fatigue and can work 24/7 to the same quality;
robots perform the same task repetitively;
they will stop working when they sense a problem;

accuracy;
reduction in errors;
reduction in tolerances;

feedback;
sensors monitor quality control;
paint thickness will be within a closer tolerance; ***[3 max]***

(b) *Award **[1]** for each of **three** points in an explanation.*
health and safety;
exposure to dangerous chemicals eliminated;
paint contains carcinogenic chemicals;

no need for humans to work in uncomfortable positions (bending, stretching, *etc*.);
fatigue;
discomfort; ***[3 max]***

C7. *Award **[1]** for each distinct point **[3 max]** in each of the three explanations.*

raster cutting:
the tool path is parallel to one machine axis either X or Y;
the quality of the product is distinguished by tool type;
maximum stepover will increase quality of outcome;
the speed of cut is determined by the number of passes to be made;
reducing the number of passes (step variable) will also reduce quality;

spiral cutting:
quality of finish is usually high as long as machine step variable is at maximum;
cutting takes place in a spiral effect;
normally used for cutting parts that have circular features;
length of path longer resulting in higher length of time;

pocket cutting:
normally not used for profiling or following contours;
can be used for cutting flat parts out of a sheet of material;
due to the tool not having to raster across the material time is normally reduced;
only edges of parts are cut so very little surface finishing is required; ***[9 max]***

Option D — Textiles

D1. (a) *Award **[1]** for a definition of biomimetic to the effect of:*
the applications of methods and systems found in nature to the study of the design of engineering systems and modern technology; ***[1]***

(b) *Award **[1]** for identifying an advantage to the user of the biomimetic fabric used in the jacket and **[1]** for a brief explanation.*
scales open when dry to release body heat and keep wearer cool;
scales close when wet so water runs off and wearer stays dry and warm; ***[2]***

(c) *Award **[1]** for each of **three** distinct points in a discussion of **one** issue relating to biomimetic fabrics in the development stage which would be addressed through market development for the fabric.*
cost;
in the early stages of development the cost tends to be high and the market small;
all the fixed costs of development have to be covered by a small market;
market development would find new markets for the product;
this would enable the fixed costs to be spread over a larger market and reduce the cost per product; ***[3 max]***

D2. (a) *Award **[1]** for stating **one** way in which the EU Flower system contributes to limiting the environmental impact of a cotton product.*
no pesticides used in cotton production;
seeds used for growing cotton the following year or for oil production/animal fodder;
reduction in noise of machineries in production areas;
use of cleaner technologies;
low/no toxicity dyes used;
treatment of waste water before release from the factory;
cutting arranged to minimize waste; ***[1 max]***

(b) *Award **[1]** for identifying **one** benefit of the EU Flower system for consumer confidence when purchasing a textile product and **[1]** for a brief explanation.*
environmental quality mark;
consumer knows there has been cradle to grave analysis of the product and the negative impacts ameliorated;

clear criteria which products must comply with;
independently verified and monitored by EU; ***[2 max]***

D3. (a) *Award **[1]** for identifying **one** way in which the Spinning Jenny impacted on the development of the textile industry.*
increased volume of production was possible;
one thread at a time had been produced pre-mechanization with Spinning Jenny, eight and later up to 80 threads could be produced simultaneously by one worker;
spinning had been an obstacle to progress;
Spinning Jenny contributed to massive expansion of the industry; ***[2 max]***

(b) *Award **[1]** for identifying **one** way in which mechanization in the textile industry impacted on working conditions.*
shift from domestic/craft production working to factory/volume production;
spinning had been domestic industry undertaken by women;
mechanization made it a factory-based industry with men and women involved; ***[2 max]***

D4. *Award **[1]** for identifying each of **two** considerations relating to the biocompatibility of materials for prostheses and **[1]** for each of **two** distinct correct points of explanation, **[3 max]** per consideration.*
have to do tests in a wide range of people;
different people react in different ways to a material;
have to test in a wide enough range of people to ensure that any issues are detected;

have to test material in context of product being used;
materials cannot be tested in isolation from the product;
in the product they may cause particular biocompatibility problems which are not observed when tested in isolation; ***[6 max]***

D5. (a) *Award **[1]** for identifying **one** triple bottom line factor relating to the development of the textile industry and **[1]** for a brief explanation.*
economic;
textile industry a major economic force for wealth creation;

environmental;
many of the chemicals, *e.g.* dyes, used in the textile industry are toxic if they enter water courses;
textile industry is noisy/noise pollution;

social/socio-cultural;
textile industry has a bad record as an employer in developing countries;
sweatshops/low pay/poor working conditions/seen as exploitative; ***[2 max]***

(b) *Award **[1]** for identifying **one** effect of import quotas on the commercial development of the textile industry and **[1]** for a brief explanation.*
import quotas limit the volume of product to be imported into a particular country, *e.g.* the United States, and protect home markets;
quotas can hold prices up which might be reduced in an open market;
they put limits on the volume of production and may reduce investment in new technologies, *etc.*; ***[2 max]***

(c) *Award **[1]** for identifying **one** link between global communication systems and the growth of multinational textile companies and **[1]** for a brief explanation.*
distributed design and production;
design teams can be in one part of the world and production can be in another part of the world;

production units can be in parts of the world where the production costs are lower, *e.g.* in developing countries;
global communication systems allow the transfer of large volumes of data so CAD element can be in one place and CAM/manufacture element elsewhere; ***[2 max]***

D6. (a) *Award **[1]** for each of **three** distinct points in an explanation of the influence of technology push on wearable computing clothing.*
technology enables new product development/innovation;
this overcomes some of the issues that have been barriers to wearable computing clothing;
a market then needs to be developed for the wearable computing clothing; ***[3]***

(b) *Award **[1]** for each of **three** distinct points in an explanation of the influence of fashion on wearable computing clothing.*
fashion has unpredictable product lifecycle;
wearable computing products are complex to produce;
product cycle needs to be short to be able to fit in with fast-moving fashion markets;

fashion market targets customers very specifically;
wearable computing has emerged from the consumer electronics market;
this does not target consumers so specifically;

psychology of fashion has implications for wearable computing garments;
wearable computing products must meet the aesthetic requirements of the fashion market;
style is critical; ***[3 max]***

D7. *Award **[1]** for each of **three** distinct points in each of **three** advantages of using laser image transfer (LIT) when designing textile products **[3 max]** for each characteristic.*
can do on CAD;
the process is software driven;
CAD links to CAM and so design can be integrated with manufacture;

the process is very cost-effective in comparison to other processes, *e.g.* sublimation printing;
it can be done at home or in factory environment;
process uses standard toner;
machine can therefore be used for normal printing tasks;

scale of production is very flexible;
it can be used for one off expensive items or for large volumes of products;
it lends itself to mass customisation;
a basic garment can be decorated/adapted;
e.g. for sports teams, birthdays, *etc.*; ***[9 max]***

Option E — Human factors design

E1. (a) *Award **[1]** for the correct answer, units are essential.*
160cm; ***[1]***

(b) *Award **[1]** for stating each of the **two** ranges, and **[1]** each for the two figures represented by the range.*
height: 160/168 – 198 / height range = 30;
weight: 54/64 – 122 / weight range = 58; ***[2]***

(c) *Award **[1]** for identifying an implication and **[1]** for each point in an explanation.*
cost;
more costly to design for these extremities;
less costly than designing a range of models;

extreme adjustments;
one chair would have to have broad adjustments;
this would lead to more complex mechanisms;

leave out 2% of the population;
extremes of height and weight are outside the 1–99 range;
impossible to design a chair to include these extremes; ***[3 max]***

E2. (a) *Award **[1]** for stating the definition.*
computer simulation of a variety of mechanical/biological aspects of the human body; ***[1]***

(b) *Award **[1]** for each point in a description of how digital humans could influence aspects of the design of the seat relating to anthropometric factors **[2 max]**.*
determine adjustment parameters for:
seat height;
seat length;
angle of back of seat; ***[2 max]***

E3. (a) *Award **[1]** for identifying the phone with greater memory burden and **[1]** for a brief explanation **[2 max]**.*
greater memory burden for phone E2(b);
because of more complex product user interface; ***[2]***

(b) *Award **[1]** for each design influence.*
technology push:
miniaturization of technology;
improved optics;
increased capacity bandwidth;

market pull:
demand for multifunctions;
convenience;
fashion; ***[2 max]***

E4. *Award **[1]** for linking primary anthropometric data with custom made, **[1]** for linking secondary data with mass produced and **[1]** for each point in an explanation.*
primary anthropometric data used with custom made desk:
designers take their own measurements;
designers conduct their own tests/experiments;
data comes directly from the individual being designed for;

secondary anthropometric data used with mass produced desk:
the use of tables and charts of figures;
dependence on the results of previous research;
the use of previous designs;
using existing desks as models; ***[6 max]***

E5. (a) *Award **[1]** for each point in a list of human factors.*
comfort;
fatigue;
posture;
pressure management;
mobility;
ease in and out; ***[2 max]***

(b) *Award **[1]** for stating the example and **[1]** for a point in a description.*
measure strength-slope ratio;
determines ease of pushing up a slope;

turning circle;
degree of manoeuverability;

reach;
access to objects, for *e.g.* in a shop;

comfort of use;
gauge how long a person could stay in a chair;

flexibility while seated;
ability to perform a range of functions; ***[2 max]***

(c) *Award **[1]** for stating a standard and **[1]** for identifying how that can result in a better design.*
performance;
stability criteria;
safer and more versatile design;
safety;
seat belts/restraints;
headrest makes it safer;
dimensions;
stability criteria;
weight support maximum;
building/door fit; ***[2 max]***

E6. (a) *Award **[1]** for each of **three** points in a discussion.*
for people who have environmentally responsible values;
using biodegradable shopping bags would provide pleasure;
because the bag embodies their values; ***[3]***

(b) *Award **[1]** for the identification of one type of pleasure and **[1]** for each of **two** points in an explanation.*
physio pleasure;
jewellery needs to enable the wearer to experience enjoyment and satisfaction from wearing it;
to promote confidence;

psycho pleasure;
jewellery needs to be peace-loving;
to promote a sense of achievement;

socio pleasure;
where the wearer is people-oriented jewellery must enable wearer to fit a chosen socio-image;
to promote a sense of belonging;

ideo pleasure;
make the wearer feel that nothing was impossible;
promote a sense of idealism; ***[3 max]***

E7. *Award **[1]** for identifying each of **three** methods and **[2]** for each point in an explanation of each method.*
scenario analysis;
identify patterns of behaviour that precede accidents;
design product to prevent the behaviour;

fault tree analysis;
identify the type of injuries that may occur;
design to prevent those injuries;

hazard assessment;
determines causes of injuries;
design to eliminate the hazard; ***[9 max]***