2009 Architectural Technology

Higher

Finalised Marking Instructions

SECTION A

Attempt all questions in this Section (total 40 Marks)

Marks

1. Briefly explain, with the aid of an annotated sketch if necessary, what is meant by the term *Ordnance Survey National Grid*.

The substance of the following is required:

- The National Grid is a network of 100km squares parallel to, and at right angles to the central reference line which lies 2^{o} West of Greenwich.
- Each 500km square is labelled with a letter HJNOST.
- Each 100km square within each 500km square is labelled with A to Z excluding I.

Any smaller square within the 100km square is located by giving a distance East then North from the South-West corner of the 100km square. **4**

2. (*a*) State the objective of a linear survey.

The substance of the following is required:

The objective of a linear survey is to gather horizontal plane data to enable the production of an accurate scale drawing of the site. **2**

(*b*) Briefly describe **two** items of ground data which are generally collected when carrying out such a survey.

Detail gathered would include: the nature and location of all boundaries; positions of existing buildings, roads and waterways; location, species and size of trees; shrubs and vegetation; site orientation. **4**

3. You are to be responsible for the setting out of a new building in a built-up urban area. All construction levels are to be related to Ordnance Datum (OD).

(*a*) How would you determine the location of the Ordnance Bench Marks (OBMs) in the vicinity of the site?

One method to be identified in the answer. Acceptable answers are as follows:

- By reference to a scale 1:1250 OS map of the area.
- By reference to the bench mark list for the area.
- By reference to the Ordnance Survey giving co-ordinates of the site. **2**

(*b*) Briefly explain how you would use an Ordnance Bench Mark to establish levels on site, and how you would control the accuracy of day-to-day levelling work.

The engineer would establish a temporary/transferred bench mark (TBM) on site by levelling from the most conveniently-located OBM. This TBM would be used for day-to-day levelling work. **4**

Marks

4. A survey line has a slope-measured length of 76·18m and an Abney level reading of 4·4°. Calculate the horizontal plan length.

Horizontal plan length = 75·960m **4**

5. Briefly explain what is meant by the term *Building Design*.

The substance of the following is required:

- Systematic or logical process from inception to final, documented proposals for a building.
- Final proposals for construction.
- Systematic development process from the initial idea to final proposals. **4**

6. Identify **four** examples of how the construction industry impacts *negatively* on the environment and briefly explain what steps are being taken to reduce the damage.

The substance of **four** of the following is required:

- extraction of raw materials
- production processes for materials and components
- construction processes
- building use
- demolition
- disposal of wastes
- transportation of materials and wastes

(4 x 1)

Strategies to reduce damage. The substance of **four** of the following is required:

- Reduction in the extraction of raw materials through changes in construction methods and greater use of local recycled materials.
- Reduction in landfill through greater use of recycled materials.
- More use of materials from economic, renewable sources.
- Reduction in energy consumption of occupied buildings through increased levels of thermal insulation, greater use of solar gain and the use of local combined heat and power schemes.
- Observation of the Environmental Protection Act 1990.
- Completion of Environmental Site Investigations (ESI).
- Use of BREEAM to allow environmental assessment of premises to be carried out.

(4 x 1) **8**

Marks

7. An outline design for a small housing development is to be prepared.

List **eight** items of information the designer will require from the client, prior to commencing work on the design.

Eight items of information required from the following list:

- type/use of building
- site location
- site ownership
- known details of ground conditions and existing services
- size and shape of building
- materials, finish and colour preferences
- accommodation and amenity requirements
- services requirements
- maintenance requirements
- target cost
- target completion date
- details of any future developments or expansion **8**

(40)

SECTION B

Attempt any TWO questions in this Section (total 60 Marks)

Marks

8 (*a*) A surveyor completes the linear survey of a site using a 30m steel tape. On completion of the survey work a check on the length of the tape indicates that it has stretched and has an actual length of 30·28m.

(i) Determine the true length of a line that was measured in the survey as 293·26m.

No of tape lengths measured = 293·26/30 = 9·775 tape lengths
Correction (c) = (30·28 – 30·00) x 9·775

= +2·737m

Actual length of line = 293·26 + 2·737

= 295·997m **4**

(ii) Identify **two** other possible sources of error that may occur, apart from that mentioned in part (*a*), when determining horizontal lengths by means of a steel tape.

Two sources of error required from:

- Incorrectly reading tape.
- Incorrectly recording in the chain (line) book.
- Miscounting the number of chain/tape lengths.
- Ranging error; chain/tape not ranged in straight lines.
- Slope of ground; slope lengths not corrected to horizontal lengths.
- Sag of tape in step measurement in sloping and uneven ground. **2**

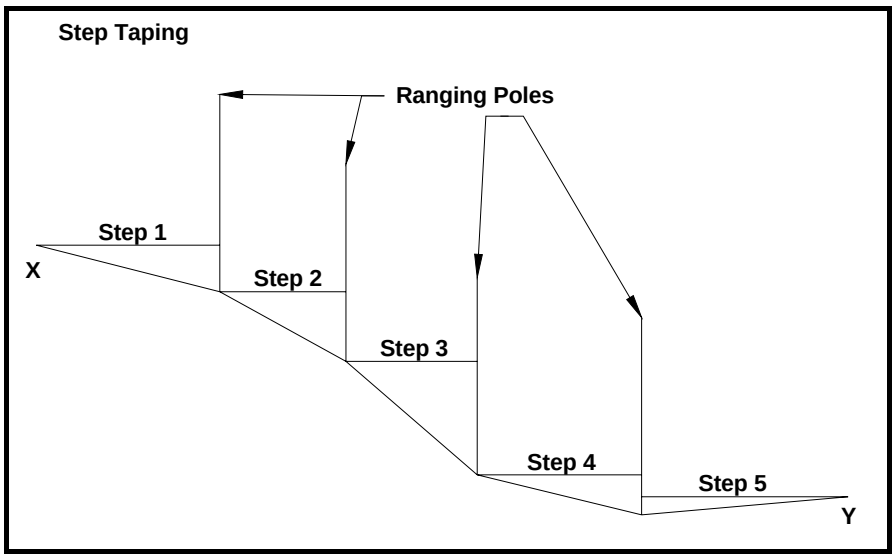
(iii) For each source of error identified in your answer to part (ii), briefly explain what a surveyor may do to reduce the error.

The substance of the following is required:

- All measurements from the tape should be read at least twice.
- All entries should be recorded in the field book and rechecked with the taped measurement.
- A known quantity of arrows should always be used when measuring long lengths and be both counted out and counted in.
- Tapes and chains should always be ranged in straight lines.
- Ensure slope angles are recorded and slope lengths are clearly recorded as such.
- Tapes and chains should be supported when taping in sloping ground, curtailing the measurements to short lengths if necessary. **4**

Marks

(*b*) Briefly describe, with the aid of an annotated sketch, how *step taping* is carried out to establish the horizontal length of a survey line on sloping ground.



4

(*c*) Briefly explain **two** functions of the foundations to a building.

A brief explanation of **two** of the following is required:

- To transmit loads from the building and external effects to the ground.
- To control the total and differential settlement.
- To provide a level base for the superstructure construction. **4**

(*d*) Briefly describe the soil conditions which would lead to the following types of foundations:

(i) deep strip (trench fill);

The substance of the following would be required:

Deep strip foundations would normally be used in shrinkable clay soils. It is necessary to take the foundations down to a depth at which the subsoil will not be subject to seasonal variations in moisture content. This is normally 900mm to 1000mm below ground level. **2**

(ii) short bored piles with ground beams.

The substance of the following would be required:

Piled foundations are used to transmit loads from structures through weak, soft soils and made up ground to more suitable bearing strata. The use of short bored piles in house construction is restricted to cohesive soils such as shrinkable clays. **2**

(*e*) Briefly explain, with the aid of an annotated sketch, how you could provide adequate *thermal insulation* to **each** of the following elements of a domestic building:

A brief explanation of a suitable method for each element is required

(i) external brick cavity walls;

2 marks for quality of sketch/2 marks for correct selection of insulation material and correct location in cavity wall.

Selection to be made from insulating block inner leaf, insulation board on inner surface of cavity, insulation to external face and protective coating, composite insulation/plasterboard applied to inner face or other suitable method. **4**

(ii) suspended timber ground floor;

2 marks for quality of sketch/2 marks for correct selection of insulation material and correct location in suspended timber ground floor.

Selection could be made from rigid insulation board, insulation quilt or other suitable method. **4**

(30)

9. (*a*) **Figure Q9(a)** shows a set of levels taken during the survey of a construction site.

Using **Worksheet Q9(a)**:

(i) book the levels; **5**

(ii) reduce the levels using an appropriate method; **5**

(iii) carry out an appropriate arithmetic check on the reduction; **2**

(iv) state the magnitude of the closing error in the survey and suggest a reason for this error. **2**

(b) Briefly describe **two** common forms of house construction currently in use in the UK. In your answer mention the construction methods and materials used for each form of construction.

The two forms of construction both use a cellular structure in which both external and internal walls can be load-bearing. This is achieved by the use of **traditional construction methods** or **timber-framed construction methods.**

In traditional construction, the external walls are of load-bearing masonry and also provide the enclosure and weather protection to the building. Floors are generally of timber and roof structures are normally formed using triangulated timber trusses.

In timber-framed construction, timber components are used to form a structure which transmits all loading to the foundations. The external cladding, which is normally in masonry, is non load-bearing, and provides the enclosure, weatherproofing and external appearance. **6**

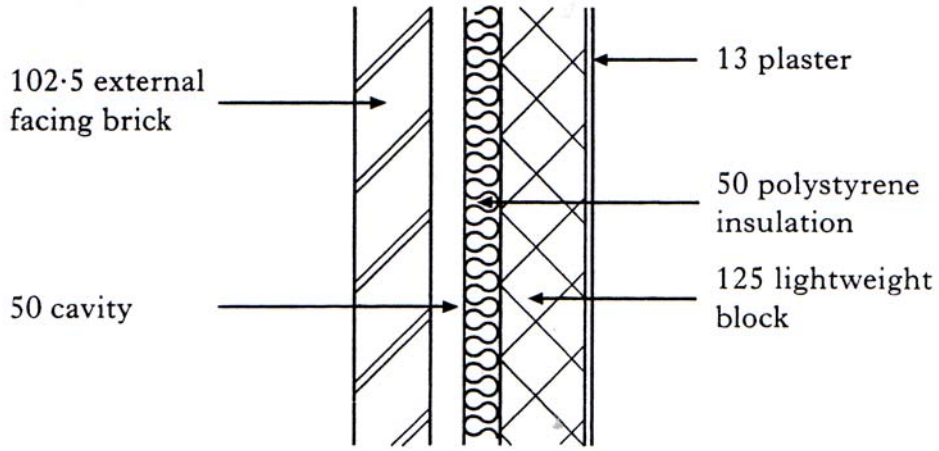
Marks

(c) For **each** form of construction described in part (b), prepare an annotated sketch showing a suitable construction for the external walls.

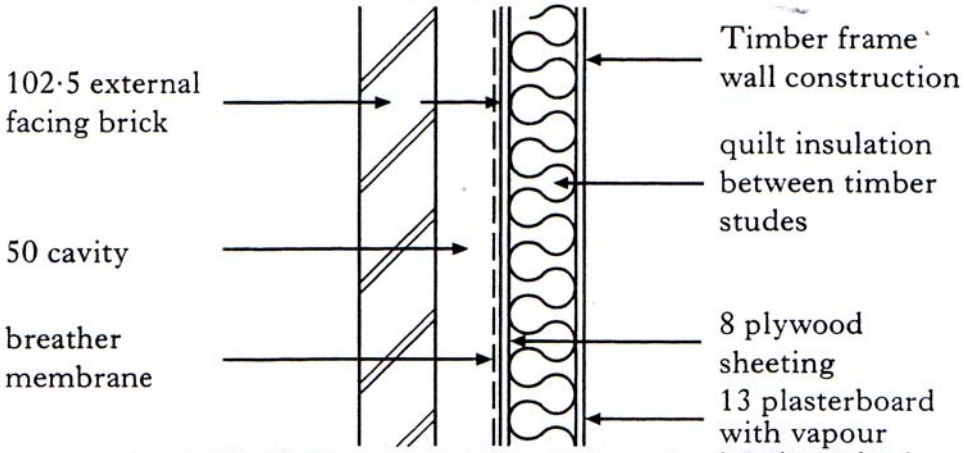
Traditional construction

Sketch required of construction based on partial cavity fill, fully cavity fill or dry lining.

Typical sketch showing partial cavity fill.



Timber framed construction



10
(30)

Marks

10. Refer to the 1:2500 scale Ordnance Survey Sitemap and answer the following questions.

(*a*) What area of ground is covered by grid square 760004?

10,000m^2 or 1 Hectare **2**

(*b*) Briefly describe **four** details contained in grid square 756004.

Square includes: Old School House, Car Park, Fountain, Bench Mark, Lighting Bollard, Foot Bridge, Signal Post, Station, Station House, Railway and Road. **4**

(*c*) Identify the building that has the 10m grid reference 75430043.

Electricity Substation **2**

(*d*) Determine the average gradient of Ardbroilach Road between its junction with the High Street and the point at grid reference 7570400873.

Height Difference = 248·7 – 230·7 = 18·0m
Length = 217m
Gradient = 1:12·05 or 8·29% **4**

(*e*) State the meaning of **four** of the symbols shown in grid square 753011.

Symbols include coniferous and deciduous trees, walls, boundaries, road, footpaths. **4**

(*f*) Briefly explain how the design of a building may be influenced by the following *Design Factors*:

The substance of the following is required:

(i) safety;

Factors which impact on the design of the building would include fire escape, fire prevention, access for fire services, accident prevention and occupant safety. These elements would dictate fire escape routes, number, width and distance of escape routes and the choice of materials to control the spread of fire. Occupant safety is considered in the use of the building and the service supplies and distribution within the building. **2**

(ii) spatial suitability;

Factors which impact on design would include building and room dimensions, occupant movement and circulation, flexibility of space, access and escape, security and provision for the disabled. **2**

(iii) architectural appearance/aesthetics.

Factors which impact on the design would include space requirements, scale, proportion, harmony, fashion, colour, texture and landscaping. Choice of materials and components and their relation in location on the building along with the surrounding built and natural environment would also influence the appearance of the building. **2**

Marks

(g) Briefly describe **two** important properties of each of the following materials and state where in the building they would be used:

(i) lightweight concrete blocks;

Properties: Strength, thermal resistance, fire resistance. Used for internal leaf of traditional wall construction. **2**

(ii) hardwood;

Properties: Strength, durability, thermal resistance, easily shaped. Used for internal finishes and windows and doors. **2**

(iii) unreinforced concrete;

Properties: Compressive strength, durability, density, fire resistance. Used in foundations and fully-supported ground floor slabs. **2**

(iv) gypsum plasterboard.

Properties: Lightweight dry finish, thermal insulation, fire resistance. Used for dry lining to external walls, partitions and ceilings. **2**

(30)

WORKSHEET Q9 (a)

(i) Booking
(ii) Reduction

All entries in metres

Back Sight	**Inter Sight**	**Fore Sight**	***Ht of Collimation*** (or) **Rise & Fall**	**Reduced Level**	**Remarks**
3·202			**80·502**	**77·300**	**OBM 77·300**
	2·779			**77·723**	
	2·720			**77·782**	
2·318		**1·600**	**81·220**	**78·902**	
		2·950		**78·270**	**TBM 78·530**

(iii) Arithmetic Check

Back sights = 3·202 + 2·318 = 5·520
Fore sights = 1·600 + 2·950 = 4·550
Difference = 0·970

TBM – OBM = 78·530 – 77·300 = 1·230

(iv) Closing error

Closing Error = 0·260

The reasons for the closing error can be:

- wrong interpolation of 1mm reading in back sights and fore sights
- movement of the staff at change points between readings
- the level has not been set up correctly
- the level has moved during readings being taken
- carelessness.

[END OF MARKING INSTRUCTIONS]