

Department of Geology & Geophysics
Mid Autumn Semester Examination 2018-19

Name of the Subject- RS and GIS (EX51003)
Total Marks: 60

No. of Students: 20+27
Time: 2 Hours

[Maintain sequence when answering. Draw neat diagrams whenever necessary]
Answer any 4 questions

1. Explain given statement as True or False

[5 X 3]

- i. Radiance is unit less
- ii. In UTM projection system, lat-long grids are perpendicular.
- iii. Band1 or blue band of ETM satellite image is 'blue' in colour.
- iv. Linear stretch image and reflectance image are equivalent.
- v. River channel can be taken as GCP for georeferencing.

X 2. Differentiate following pairs

[5 X 3]

- a) Radiance & Digital number,
- b) 4-3-2 & 6-5-4 band combination of Landsat ETM for vegetation
- c) UTM zone 45N & WGS 84
- d) RGB & IHS
- e) Digitization & Quantization

3. Give details of ideal remote sensing system. How does it differ from original? What are different image interpretation keys?

[5+5+5]

4. What is georeferencing? What are different steps for georeferencing? During georeferencing, a Landsat image was resampled into a grid-spacing of 10m. A road within that image was represented with total 500 pixels. What could be maximum length of that road? For representing that same road in normal Landsat satellite image; how many pixels will be required?

[5+5+5]

5. How much relief displacement you will expect for 20m high building in an aerial photo with radial distance from Principal Point (PP) 10 cm. Flying height is 2000 m. If focal length of the camera is 1m, what will be the length of 5m long bridge in aerial photo near PP?

[10+5]

-----End-----

INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR
Date: 24th September, 2018 AN

Time: 2 Hrs.

Full Marks: 30

Department of Mining Engineering;

No. of students 24.

Mid Autumn Semester Examination 2018-19.

Subject No. MI40039; Subject Name: ELEMENTS OF PETROLEUM ENGINEERING

4th Year B.Tech.(H) in Mining Engineering

Instructions:

Answer ALL questions.

Any missing data may be assumed and stated.

1. With neat sketches explain:

- i) The various types of oil and gas traps.
- ii) The generation of biogenic gas, thermogenic gas and oil in source rocks with respect to geothermal gradients.
- iii) Primary and secondary migration of hydrocarbons.

3X2 = 6

2. i) Explain the various types of geophysical logging methods and how such data can be used to identify a potential target for drilling of oil and gas wells.

ii) Compare and contrast "core analysis data" and "logging data" of the same reservoir rock.

2+2= 4

3. The PVT data for X-reservoir is provided in Fig.1. Calculate the following:

i) The recovery factor for the stock tank oil of above reservoir when the reservoir pressure falls from initial pressure to bubble point pressure;

ii) The initial oil in place, if the reservoir produced 680,000 STB of oil when the pressure dropped to 3550 psia;

iii) Recovery factor if the cumulative GOR at 2800 psia is 3300SCF/STB, reservoir temperature is 190°F and standard conditions are 14.7 psia and 60°F;

iv) Recovery factor if the two-thirds of the produced gas had been returned to the reservoir under the above conditions for the same reservoir.

4X2 = 8

4. The following data refer to a 1.5 inch block line with 10 lines of extra improved plough steel wire rope strung to the travelling block: hole depth = 10,000ft.; drillpipe = 5 in. OD/4.276 in. ID, 19.5lb/ft.; drill collars = 500ft., 8in./2.825in., 150lb/ft.; mud weight = 10ppg.; line and sheave efficiency coefficient = 0.9615; density of steel = 489.5lb/cu.ft. Calculate:

i) Round-trip in ton-miles at 10,000ft;

ii) Casing ton-miles if one joint of casing is 40 ft..

iii) Design factor of the drilling line when the 9⁵/₈ casing (36lb/ft.) is run to 10,000ft;

iv) The ton-miles when coring from 10,000 to 10,180ft;

v) The ton-miles when drilling from 10,000 to 10,180ft.

5X2 = 10

2300

5. With examples discuss the basic functions of oil and gas well drilling fluids.

2

11
Σ

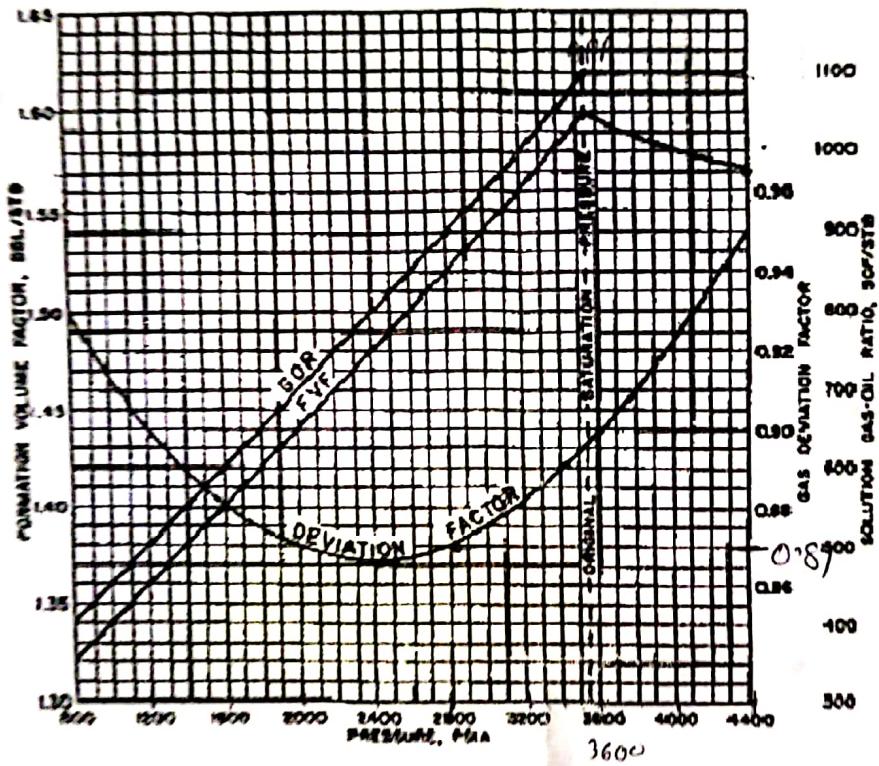


Fig.1. The PVT data for X-reservoir.

Indian Institute of Technology

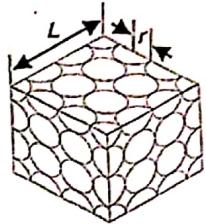
Date:
Autumn: 2018 Midterm

FN/AN

Time: 2 hrs.

Full marks: 60,
Dept. Geology & Geophysics

Sub. No. GG 52007/52010 Energy Resources

1	<p>(a) Sand grains of identical spheres of radius r having cubic arrangement of packing occupy a cubic unit cell of length L, as shown in the given figure. Calculate its porosity.</p> <p>(b) How the Mercury injection curve can be used to assess the reservoir quality?</p> <p>(c) What do you understand by 'Water cut' in a reservoir?</p>		$4+4+2 = 10$
2	<p>a) What does Rock-eval do, what does it report, and what can be inferred from it?</p> <p>b) In a prospective basin kerogen vitrinite reflectance in a potential source rock has been measured as 0.9. Assuming a normal geothermal gradient calculate the maximum depth of burial.</p> <p>c) "Illites are bad for reservoirs. But Illite/Smectite ratio, along with Vitrinite reflectance and apatite Fission track can be effectively used to retrieve the burial and thermal history of a basin". Can you briefly explain the rationale behind this statement?</p> <p>d) What is Carman-Kozeny equation? A sandstone reservoir has 12% porosity but 38% clay. Will it be productive to oil? Justify your answer.</p> <p>e) What is contact angle? How as a function of time the Oil-saturation (S_o) or the recovery rate of a carbonate reservoir will differ from a siliciclastic one?</p>	$5 \times 5 = 25$	
3	<p>Give reasons/justify the following statements:</p> <p>(a) Thermal power plants are constructed close to coal mines (pit heads) while nuclear power reactors can be constructed far away from uranium mines.</p> <p>(b) The applications of nuclear reactors are manifold apart from routine use in power generation.</p> <p>(c) Seismic zonation/ micro-zonation studies are an essential attribute to locate sites for various types of power reactors and allied applications, in addition to other energy generation mechanism.</p> <p>(d) The peripheral walls/enclosures surrounding nuclear reactors could generally be made of fly ash composites or other low radioactivity materials.</p> <p>(e) Nuclear reactors are preferably located along the coastal parts of India.</p>	$5 \times 2 = 10$	
4	<p>Enumerate the various neutron induced fission reactors used for generation nuclear Power. Why some fission reactions are more efficient than the others? What are the essential differences between a Boiling Water Reactor and a Power Reactor respectively?</p>	15	

Department of Geology and Geophysics, IIT, Kharagpur

Mid Semester Autumn 2018-2019 Subject: Borehole Geophysics EX51001

Instruction: All questions are compulsory.

' Total Marks: 60

Time: 2hr

Question Number	Question	Marks
1	Draw a label diagram to illustrate idealised invasion profile and variation of resistivity and invasion diameter in permeable zone. Give the full form of abbreviation to be used for labelling.	7
2	Derive the Archie equation considering an idealized cube model.	7
3	Write short notes for the following; a)Skin Effect for Induction logging b)Stoneley Waves in borehole c)Irreducible water d)Cycle skip in Sonic Log	5
4	For a given Sonic log at depth 493m, we read 332 μ sec/m. Given $\Delta t_{ms} = 182 \mu$ sec/m. Solve to find the porosity ϕ using Wyllie and Raymer-Hunt equation.	6
5	Give all the geological factors that influence the measurement of NMR (Nuclear Magnetic Resonance) logging.	10
6	Explain with suitable sketch of all possible way of explaining distribution of shaly formations. Also give the mathematical relation for bulk volume fractions.	10



INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

MID-AUTUMN SEMESTER 2018-19

Date of Examination: 19.09.2018, Session (FN/AN): AN, Duration: 2 Hrs., Full Marks: 30, Subject No.: MA31011, Subject: OBJECT ORIENTED SYSTEMS DESIGN

Department/Center/School: Mathematics

Specific chart, graph, log book etc., required:

Specific Instructions (if any):

Answer all questions. Each question carries 10 marks. The acronym OOP is used for Object Oriented Programming.

1. (a) What do you mean by object, functional and dynamic models in OOP? State the car speed control problem. Draw the object and dynamic models for it.

[4 Marks]

(b) Write a function called **reverse()** in C that reverses a string given as an array of characters. Use a for loop that swaps the first and last characters, then the second and next to last character and so on. The string must be passed to **reverse()** as an argument.

[4 Marks]

(c) What will be the output of the following code segment if all the variables are integer type?

10

```

sum = 0;
ocount = 1;
while(ocount <= 3)
{
    iCount = 1;
    while(iCount <= ocount)
    {
        sum = sum + iCount;
        iCount++;
    }
    oCount++;
}
cout << sum << endl;

```

1, 2, 4, 5, 7, 10

sum = 1
sum = 2
sum = 4 ✓
sum = 5
sum = 7
sum = 10

20
2+4
1+2+4
2+4+5
1+2+4+5
1+2+4+5+7
1+2+4+5+7+10
20

2. (a) Distinguish between the Procedural and OOP languages by explaining their advantages and disadvantages over one another. Write at least five benefits of OOP approach in program development. [4 Marks]
- (b) Define Generalizations, Aggregation and Inheritance. Give suitable examples to explain each one of them. [3 Marks]
- (c) Write a simple program to find the factorial of a given number. [3 Marks]
3. (a) Define Constructors and Destructors. How are they called in a program? [3 Marks]
- (b) What do the following statements mean?
(i) int p(char (* a)[10]);
(ii) int (* p[10]) void;
(iii) int * (* p)(char * a[]); [2 Marks]
- (c) Write a simple program to model a restaurant reservation system, where a staff can be able to make a reservation, pull up or cancel a reservation. The program should contain the details of the reserver such as its name, phone number and e-Mail, start time and end time of the reservation, party size etc. [5 Marks]

***** END *****

Date:

FN/AN

Time: 3 hrs.

Autumn: 2018

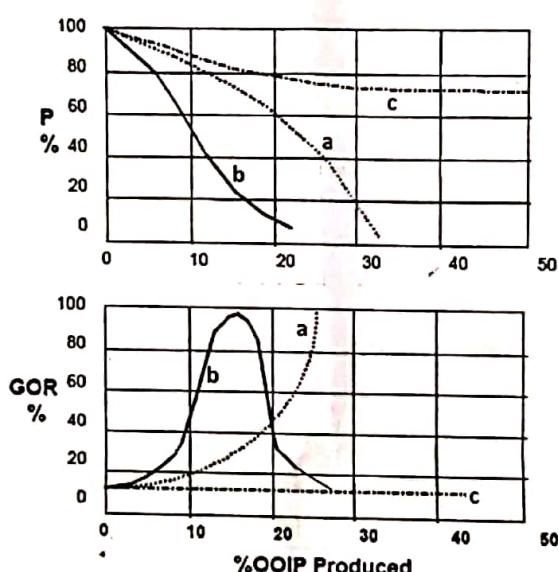
Full marks: 100

No. of students:

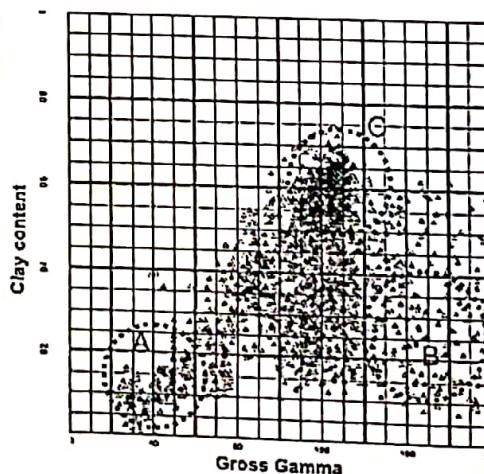
Dept. Geology & Geophysics

Sub. No. GG 52010/52007 Energy Resources

- 1 a) How Stiff diagrams are constructed?
 b) Explain why $\delta^{18}\text{O}$ - δD slope of oil field brines deviates from meteoric water line?
 c) How, as a function of time, the Oil-saturation (S_o) or the recovery rate of a carbonate reservoir will differ from a siliciclastic one?
 d) In a reservoir, edge water in the aquifer (resistivity $\sim 0.5 \Omega\text{m}$) was wrongly sampled instead of bottom water below the oil/water contact (resistivity $\sim 0.2 \Omega\text{m}$). Considering Archie's factor = 16 and $R_t = 25 \Omega\text{m}$, calculate its effect on oil saturation estimation.
 e) Below given are the Pressure trends and Gas-Oil Ratio (GOR) under three different natural drive mechanisms a,b,c. Identify each drive mechanism.

5x5
=25

- 2 (a) What is Shale Gas? (b) Given the typical nano-darcy level permeability in gas shale explain why clay mineralogy plays very important role in deciding its reservoir quality? (c) The accompanied figure shows clay content against gross Gamma in a thermally mature shale unit. Out of the three encircled domains A,B,C which one can be a probable gas shale reservoir and why?

2+4+4
= 10

3	(a) What is formation Volume factor? (b) How will you calculate "STOIP"? (c) An undersaturated petroleum-bearing sandstone is characterized by the following parameters. (i) Area = 130 sq km, (ii) average 'pay' thickness = 20 m, (iii) average porosity = 18%, (iv) average water saturation = 25%, (v) FVF (Formation volume factor) = 1.1, (vi) specific gravity of petroleum = 0.9. What is the in place (STOIP) geological reserve of this pool?	2+3+ 10=15
4	(a) What are the main methanogenic pathways required for the formation of methane hydrate? Give one example of chemical reaction for each. (b) Briefly discuss the principle of using the Bottom Simulating Reflectors in detecting marine Gas hydrate zones?	4+6= 10
OR (answer any one between Q. 4 & 5)		
5	(a) What is the difference between giant and super-giant oilfields? (b) What is 'Inferred Reserve'? (c) Assuming the current production rate for oil continues, explain the life of global reserve.	2+2+6 =10
6	Enumerate the various methods used for Nuclear Waste Disposal. Elaborate the methods which are presently being employed in India? What are the important parameters used for designing a Nuclear Waste Repository? How is "Rheidity" important for the same? How are the following subsurface data, utilized for locating plausible sites for Nuclear Waste Disposal? (a) Primary and Shear Wave velocities (b) Radioactivity Concentrations in rocks (c) Resistivity Sounding data	20
7	Which are the specific aspects/parameters, used for localization of areas for designing of Nuclear Waste Disposal site? Why granites are preferred, as the lithology for waste disposal sites? Why are geological repositories, economically more useful (as compared to other methods) for nuclear waste disposal?	20

Department of Geology and Geophysics, IIT, Kharagpur

Semester Autumn 2018-2019 Subject: Borehole Geophysics EX51001

Instruction: All questions are compulsory.

Total Marks: 100

Number of students: 29(5yrs Integ.); 16(2yrs)

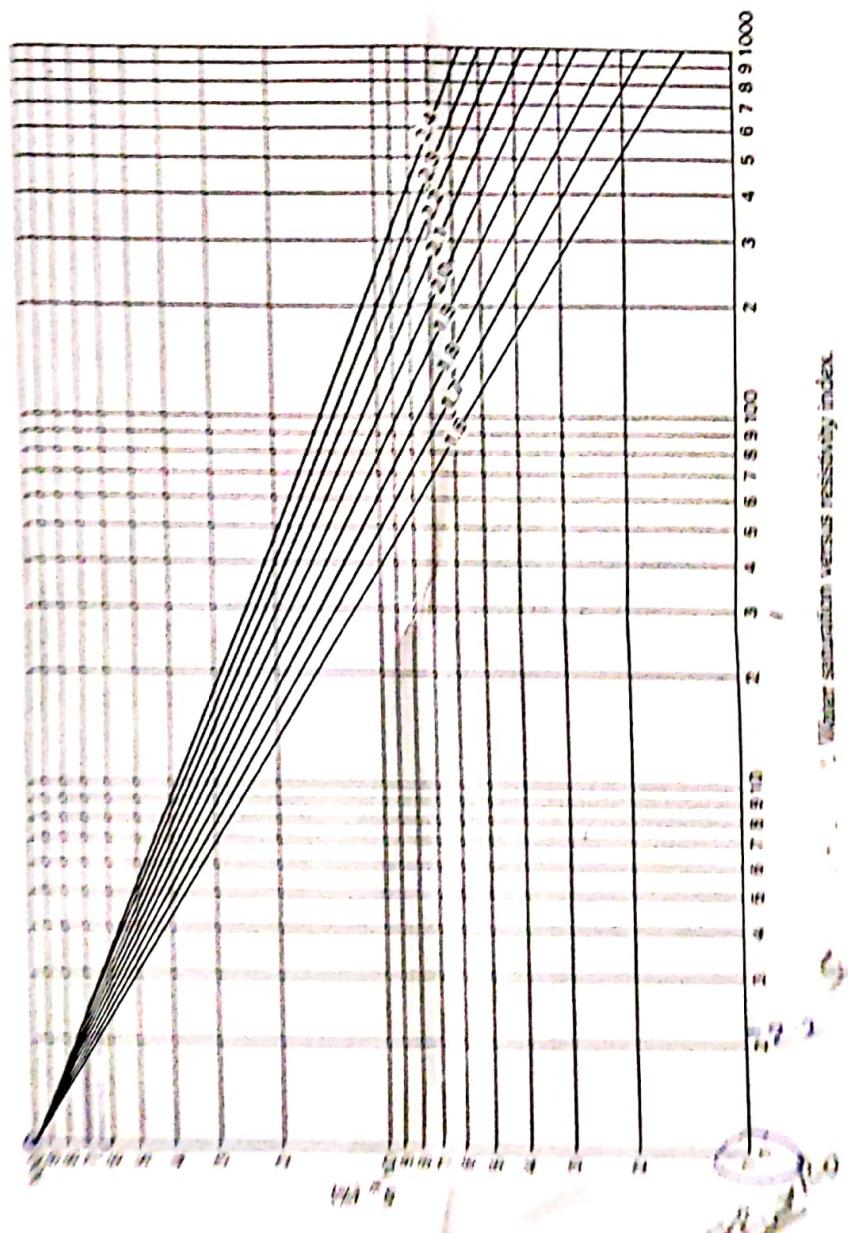
Time: 3hr

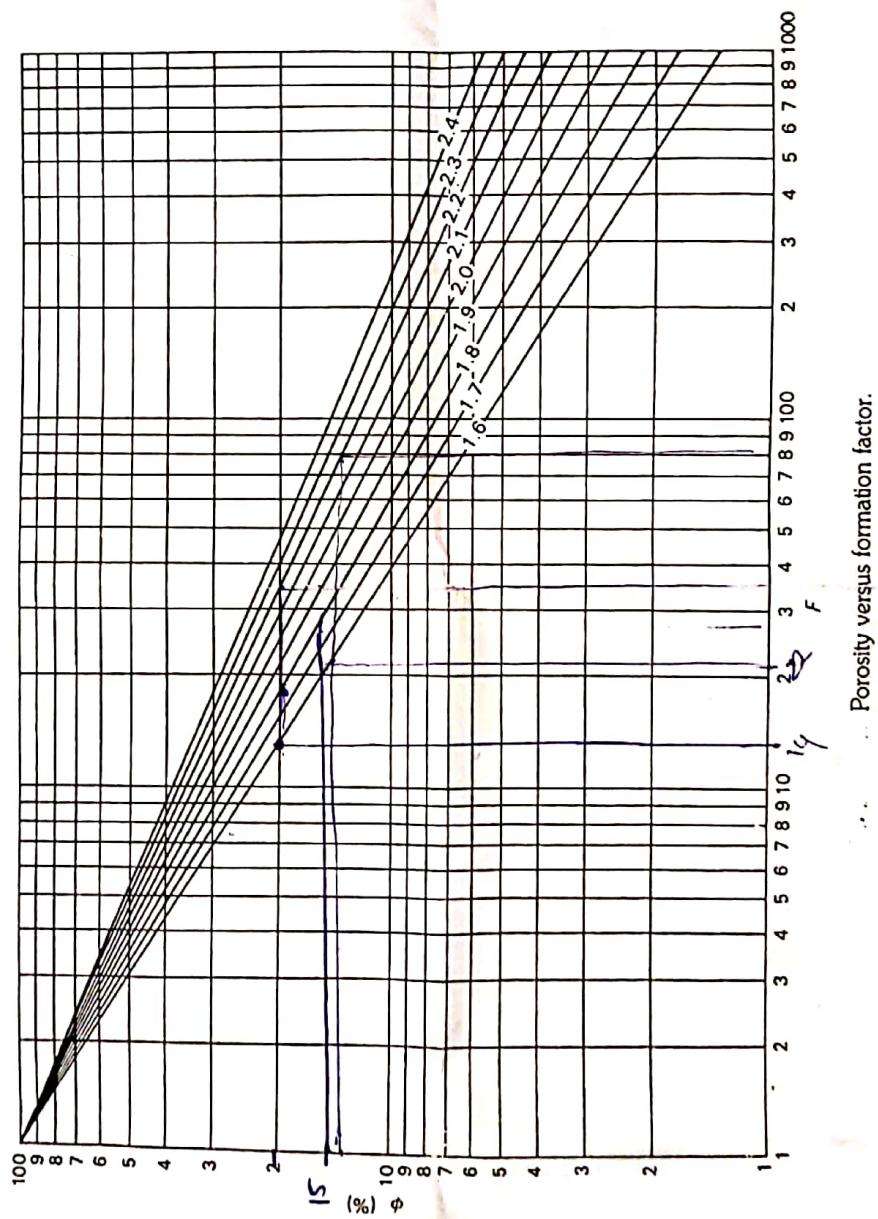
Q No.	Question	Marks
1	a)State the rock-fabric petrophysical parameters in carbonate reservoir that can be obtained as output from the following wireline logs as input: (i) Total porosity; (ii) Transit time; (iii) True resistivity; (iv) R_w ; (v) Lithology; (vi)Saturation exponent. b)State the facies and rock fabrics of carbonate reservoir likely to be recognised from the following wireline logs: (i) Spectral gamma ray; (ii)Porosity; (iii)Acoustic-porosity cross plots; (iv) S_{wi} - ϕ cross plots; (v)Lithology; (vi)Image logs. c)Give the global permeability transform using rock fabric number(rfn) and inter particle porosity(ϕ_{ip}). d)Define the following: (i) Absolute permeability(K_a); (ii) Effective Permeability (K_e); (iii)Relative Permeability(K_r) e)State Darcy's Law with figure and equation.	3 3 3 3 3
2	Give the interpretation for the following condition encountered during wire line log:(i) Gamma log value is low and Neutron Log value is low; (ii) Gamma log value is high and Neutron Log value is medium; (iii) Resistivity log is low and SP log is low; (iv) Resistivity log is high and SP log is high	4
3	Write short notes for the following: a)Bound Water b)Shale point and shale line c)Gas effect d)Liquid junction potential	5 5 5 5
4	Draw a chart for effective permeability to flowing fluid and illustrate residual oil saturation (ROS) and irreducible water saturation (S_{wirr}). Also explain the terms.	5
5	What is TVT(True vertical thickness) of a chromite ore plug that MLT(Measured Log thickness) of 40m, borehole dip of 36° , borehole direction of 89° , apparent horizon dip of 32° , and horizontal; dip direction of 78° ?	5
6	Illustrate how at (i) high salinity (ii) low salinity the current flows in a double layer model of shaly formation. Also give the equation for the theoretical calculation of the conductivity in terms of cation exchange capacity per unit volume.	5

PTO(1/2)

$$\frac{1}{F} \left(C_w + B \phi_v \right) = \frac{1}{F^*} \left(C_w + B' \phi_v \right)$$

Q No.	Question	Marks
7	Illustrate the behaviour of shaly samples of sandstone measurement of the formation factor as a function of porosity with the samples happened to be saturated with (i) very saline water (ii) quite low-salinity water.	5
8	a) State the formation evaluation challenges faced in the case of unconventional reservoir (b) State the new formation properties required for shale gas analysis. (c) State different method with description that is used to find total organic carbon from logs.	12
9	State what happens in a situation when thin laminated clastic reservoir, the sand layers are sandwiched between high conductive shales? You need to state the problem that arises and corresponding solution to be given. Give requisite equations, petrophysical model, along with plots to elaborate the models. Also give petrophysical model when beds are not horizontal.	14
10	a) Suppose you are evaluating a formation where R_w , porosity, and m all remain constant. The lower part of the formation is usually water wet so that you can assume that $S_w = 100\%$ in the lower part. If the lower part of the formation has a resistivity of 5 ohm-meters and the upper part has a resistivity of 11 ohm-meters, what is the hydrocarbon saturation in the upper part of the formation if $n = 1.7$?	3
	b) Suppose n is known to vary from 1.6 to 2.2. What would be the possible range for hydrocarbon saturation in the upper part of the formation?	3
	c) Consider the practical situation where porosity can vary from 15% to 20% and $m = 1.8$ (where n can still vary from 1.6 to 2.2). What is the possible range of hydrocarbon saturation in the upper part of the formation?	9
	END	2/2





$$f = \frac{\rho_w}{\rho_s}$$

Porosity versus formation factor.



INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

END-AUTUMN SEMESTER EXAMINATION, 2018-19

Date of Examination: _____, Session (FN/AN): _____ Duration: 3 Hrs., Full Marks: 50,

Subject No.: MA31011, Subject: **OBJECT ORIENTED SYSTEMS DESIGN**

Department/Center/School: Mathematics

Specific chart, graph, log book etc., required:

Specific Instructions (if any):

Answer all questions. Each question carries 10 marks. The acronym OOP is used for Object Oriented Programming.

- 1) a) What do you mean by exceptions in OOP? List at least five types of common exceptions frequently found in C++. Explain how an exception "Divide By Zero" is handled by using try and catch blocks by writing a C++ program.
b) Is it valid to have a try block without catch? Justify your answer.
c) Can a catch block throw the exception caught by itself? Explain by an example.
d) Is an empty catch block legal? Support your answer by an example.

[5+1+2+2] Marks

- 2) a) What do you mean by template in C++? Write the definition of different types of templates. Write a function template to print the array of integers, floating point numbers and user defined data types, say distances.
b) What is Polymorphism? How can the compile time and run time polymorphism be achieved?
c) What is a this pointer and a self referential pointer? Explain why they are important in software development.

[5+2+3] Marks

- 3) a) Explain the virtual, friend and static functions and show how they provide flexibilities in OOP.
b) Explain the meaning of the following statements:

- 7
(i) int (*p(char *))[10];
(ii) int *(*p[10])(char*);
(iii) int p (char (* a) []);
(iv) int (* p[10]) (void);

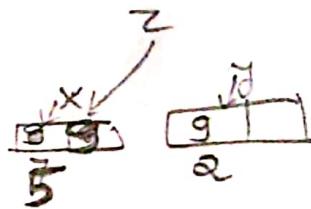
- c) Write a program to compute the annual average rainfall and and the variation (from monthly average)

[3+2+5] Marks

int (*p)(char*)
int * (*p[10])(char*)

4) a) What is the output of the following program:

```
class a{ int x;
    void pt(){System.out.println(x);}
    void cpy(a m){x=m.x;}
    static a cqy(a m){return m;}
    static a cry(a m){a u;u=new a(); u.x=m.x; return u;}
    public class MyClass {
        public static void main(String args[]){
            a x,y,z;x=new a();y=new a();z=x;y.x=9;
            x.cpy(y);
            x.pt();z.pt();x.x=7;y.x=2;z.x=5;x.pt();y.pt();z.pt();
        }
    }
}
5 9 20 59
```



b) The following two programs are same:

I) #include<iostream>
using namespace std;
main()
{ int i,p,x;
 p=22;
 for(i=1;i<=10;i++)
 { cin>>x;
 if (x>50) p=x/5;
 if (x<20) cout<<x+p;
 }
}

II) #include<iostream>
using namespace std;
class a{ public: int k,v,t;a(){k=22;v=1;}
 set function
 get function
 main()
{ int i,x,a p;
 for(i=1;i<=10;i++)
 { cin>>x;
 if(x>50) p.set(x);
 if(x<20) cout<<x+p.get();
 }
}

Define the set and get functions in the program (II) so that the similar output can be obtained.

c) Define the operators "+" and "/" such that output of the following program is 17 hr and 0 minutes,
2 5 hr and 40 mintes, 8 hr and 30 minutes, 14 hr and 10 minutes:

```

#include<iostream>
using namespace std;
class tmp
{ public: int h,m;
  void operator=(int k){h=k;m=0;};
  tmp operator+(tmp a, tmp b)
  { ... }
  tmp operator/(tmp a, int b)
  { ... }
  void pt(tmp a){cout<<a.h<<" hr and "<<a.m<<" minutes"<<;
}
main()
{
  tmp p,q,r,s;
  p=17; pt(p);q=p/3; r=p/2; s=q+r;
  pt(q); pt(r); pt(s);
}
    
```

d) Explain the multiple inheritances by giving at least two example and show how ambiguities are resolved in it. Also, find and correct the error in the following program:

Class Example {

```

private:
  int data;
public:
  Example (int y=10) : data(y) {}
  int getdata () const
  { return data++;
}
  
```

[1+3+3+3] Marks

- Q5) a) Write a program in C++ to find the dot and cross product of two vectors.
 b) Write a program to find the birth year of a person where the input is the Age as an Integer. In this program, show that how can the exception thrown by the program be handled if we enter "Nine" (in words) than the integer "9".
 c) Write a program in C++ or JAVA to filter only .Docx source files for listing in JFileChooser.

[3+4+3] Marks

***** END *****

Department of Geology & Geophysics
End_Semester Examination 2018

Name of the Subject- RS & GIS (EX51003)
 Total Marks: 100

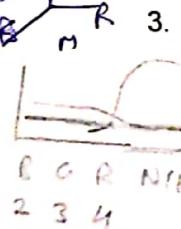
No. of Students: 20+27

Time: 3 Hours

[Answer all questions]

1. Relate DN values, radiance and reflectance. What is spectrometer? If you measure an object under sunlight using spectrometer; what will be its response for radiance versus wavelength. How reflectance curves can be obtained from hyperspectral image? Signify band ratio for earth observation.
2. What are different GIS models? Describe Raster and Vector spatial analysis? Complete following process model for determining landslide susceptibility for a fragile north-westerly dipping bedding planes.



-  3. What is colour? What are different types of colour models? Draw RGB colour cube for 8-bit image. a) An object appears in yellow colour for 3-4-2 band combination; what will be its colour for 4-3-2 band combination? b) 2 objects appear as gray in 4-3-2 band combination. In band 5, object 1 gives highest reflectance, whereas object 2 is lowest. In which band combination they can be discriminated? What will be their colours? Use colour model to explain your answer.

4. Following 3 images (i, ii, iii) have been taken in 3 different wavelength ranges. Thresholding of 16, 30, 100 have been applied respectively for (i), (ii) and (iii). Thresholded image of (i) exhibits a lensoidal object. That object is geographically coinciding with an ore body. What will be its colour for thresholded i-ii-iii RGB combinations? What is total area of ore body, if pixel resolution is 8m?

9	11	10	12	17	8	7
8	12	11	22	24	9	7
7	7	21	19	45	10	8
15	23	23	43	12	11	9
34	33	32	11	11	15	6
17	33	15	14	14	12	8
8	11	13	12	13	9	7

91	91	90	92	47	48	71
81	92	41	42	44	91	72
42	45	51	49	45	30	8
32	23	23	43	32	11	9
34	33	32	31	11	15	6
37	33	45	14	14	12	8
34	41	13	12	13	9	7

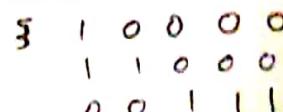
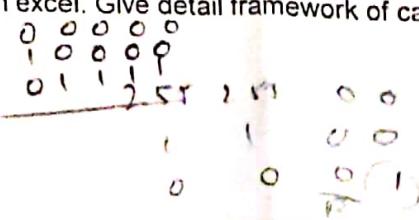
91	91	90	92	47	48	71
81	92	41	42	44	91	72
42	45	51	49	45	30	182
32	23	23	43	32	11	192
34	33	32	31	11	15	116
37	33	45	141	141	127	128
34	41	131	121	131	119	117

$$R + G = Y$$

$$R + B = M$$

$$B + G = C$$

5. What is DEM? From collection of spot observations of elevations to generation of DEM, elaborate various considerations and steps? Draw topographic and structural contours for flat-irons. If image of question 4 (ii) represents DEM; how can you calculate aspect in excel. Give detail framework of calculation and results.



INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

End-Autumn Semester 2018-19

DATE: 22nd November 2018(AN)

Time: 3Hrs.

Full Marks: 60

Department of Mining Engineering;
Subject: Elements of Petroleum Engineering (MT 40039)

No. of Students: 26

Instructions:

- (i) Answer ALL questions.
- (ii) Any missing data may be assumed and stated.

1. a) What are the basic components of oil based drilling mud?
 b) With suitable diagrams explain water-in-oil and oil-in-water type of emulsion mud.
 c) Explain Bingham plastic fluids and typical drilling fluids with the help of Shear rate vs Shear stress diagram.
 d) Explain how the Fann viscometer reading is used for plastic viscosity and yield point of a drilling mud in oilfields.
 e) With the help of Power Law model how one can determine the Consistency Index of a mud?

$$1+2+2+3+2 = 10$$

2. a) Determine the quantity of barite required for changing the density of mud from 12.53 ppg to 16.7 ppg. Calculate the increase in pit volume due to the addition of such a quantity of such a quantity of barite for an initial mud volume of 63 bbl.
 b) It is required to reduce mud weight from 25.1 ppg to 22.6ppg in order to combat a lost circulation problem. Calculate the volumes of water and oil required to bring about this reduction. Also, if oil is used, what is the percentage of oil in mud if the initial volume of mud is 629bbl? The density of oil is 6.87ppg.

$$5+5 = 10$$

3. a) Why liners used instead of casing in oil/gas wells? Discuss the advantages and disadvantages of using liners.
 b) Stepwise explain the design of a casing program in oil/gas wells.
 c) Calculate the collapse pressure for the following casing string assuming lost circulation at the casing shoe: Current mud = 15ppg; casing was run in with 11ppg; CSD is 10,000ft.

$$4+3+3 = 10$$

4. a) What are objectives of cementing a well?
 b) With a neat diagram the manufacturing process of Portland cement.
 c) What the various classes of cements used in oil industry?
 d) Discuss the various cement additive and their roles used for oil industry.

$$2+3+2+3 = 10$$

5. a) Explain various types of drives for oil and gas reservoirs.
 b) With the help of a suitable diagram derive the Material Balance Equation for a saturated oil reservoir.

$$5+5 = 10$$

6. a) Compare and contrast IOR and EOR processes.
 b) What are the various types of EOR processes used in oil industry?
 b) Discuss the various types of artificial lift systems with their objectives, advantages and disadvantages.

$$2+4+4 = 10$$

$$- \dot{m}_e + \rho_w \cdot w_p + w \cdot C_e \overline{\Delta p}$$

$$\sqrt{f} C_f \overline{\Delta p}$$

Travelling
Stanchy